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ENVIRONMENTAL ASSESSMENT BOARD



ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

VOLUME: 127

DATE: Thursday, April 2, 1992

BEFORE:

HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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ENVIRONMENTAL ASSESSMENT BOARD
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,
R.S.O. 1980, c. 140, as amended, and Regulations
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro
consisting of a program in respect of activities
associated with meeting future electricity
requirements in Ontario.

Held on the 5th Floor, 2200
Yonge Street, Toronto, Ontario,
Thursday, the 2nd day of April,
1992, commencing at 10:00 a.m.

VOLUME 127

B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

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WHITE HOUSE MEMORANDUM FOR THE PRESIDENT
DATE: 10-10-61

IN THE MATTER OF THE SUBCOMMITTEE ON INVESTIGATIONS
 SENATE COMMITTEE ON GOVERNMENT OPERATIONS

AND OF THE MATTER OF THE SUBCOMMITTEE ON INVESTIGATIONS
 HOUSE COMMITTEE ON GOVERNMENT OPERATIONS

Re: The above-captioned matters.
 The following information is being furnished to you for your information.
 The information was obtained from a confidential source who has provided reliable information in the past.

Sincerely,
 J. Edgar Hoover

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1 ---Upon commencing at 10:00 a.m.

2 THE REGISTRAR: Please come to order.

3 This hearing is now in session. Be seated, please.

4 THE CHAIRMAN: Mr. Campbell?

5 MR. B. CAMPBELL: Mr. Chairman, there are
6 two matters that Dr. Whillans would like to address.
7 The first matter has to do with a correction which he
8 believes should be made to the transcript at Volume
9 126, that's yesterday transcript, page 22051, in the
10 first line. I think he will speak to that. You really
11 have to read from 22050 over to 51, he will speak to
12 that.

13 The second matter that he wishes to
14 address arises from Dr. Connell's question with respect
15 to exposures resulting from neutron exposure in
16 background radiation, and he is prepared to address
17 that in a little bit more detail.

18 So if he could be given the opportunity
19 now, I would like to have those matters dealt with. I
20 have spoken with my friend Mr. Hamer about this.

21 THE CHAIRMAN: I forgot to bring my
22 transcript in, so I perhaps could you deal with the
23 second matter first, and then by that time we will have
24 our transcripts.

1 DAVID WHILLANS,
2 KURT JOHANSEN,
3 FRANK CALVIN KING,
4 WILLIAM JOHN PENN,
5 IAN NICHOL DALY; Resumed.

6 DR. WHILLANS: Okay. Well, Dr. Connell I
7 believe asked about a comment that was in one of the
8 materials that we were reading yesterday where it
9 referred to neutron exposures, I think in the context
10 of natural exposures, and I said I was surprised by
11 that as well.

12 I have reviewed a couple of references,
13 of the UNSCEAR 1988 document and also the NCRP, report
14 No. 94, which is 1987, and the situation is basically
15 the following: There are no common neutron emitters
16 amongst radionuclides in the environment; however,
17 within the category of cosmic radiation which accounted
18 for .3 millisieverts of the total, there is a small
19 contribution from neutrons, and there is a great deal
20 of detail in the reference. Basically at ground level
21 the contribution is something like 5 per cent of that
22 point .3 millisieverts or about .015 millisieverts, a
23 very small amount.

24 As you go up in the height the
25 contribution from neutrons increases so that it can be
as much as .245 millisieverts at 3 kilometres, and this
gets into the issue of higher dose rates during flight

1 and especially during space exploration.

2 But the source is primarily cosmic, and
3 it's the neutrons that are produced in the upper
4 atmosphere from the primary protons coming from outer
5 space. That was the second.

6 I am afraid Mr. Campbell has my notes and
7 also my only copy of the transcript.

8 Do you have your copy?

9 THE CHAIRMAN: Yes I do, thank you.

10 DR. WHILLANS: Actually, you may have
11 trouble finding pages.

12 MR. B. CAMPBELL: There was a mix up in
13 our copies of the transcript where a number of pages
14 had been bound backwards and the reporters have fixed
15 all that now.

16 DR. WHILLANS: This was on page 22051 and
17 Dr. Connell had asked a question about the
18 penetrationability of tritium radiation. On the
19 previous page he commented about it not being able to
20 escape from a secured water pitcher, and my comment was
21 it's a pure beta emitter with a very soft beta, it
22 would pass through the container as you say. And I
23 believe that should be "it would not pass through the
24 container". A fairly Change.

25 MR. B. CAMPBELL: I pointed out to the

1 witnesses that this is one of the great benefits of
2 enunciating more clearly that those things don't
3 happen.

4 DR. WHILLANS: I apologize.

5 MR. HAMER: I think they are doing pretty
6 well, Mr. Chairman.

7 THE CHAIRMAN: Mr. Hamer.

8 MR. HAMER: Mr. Chairman, I have to make
9 an advance apology. I think my time estimate was a
10 little shy yesterday. I suspect I may go into the
11 early afternoon rather than the late morning, as I
12 said, but I will do the best I can and roll along.

13 DR. CONNELL: That's today? [Laughter]

14 MR. HAMER: Yes. This week.

15 CROSS-EXAMINATION BY MR. HAMER (Cont'd):

16 Q. Mr. Penn, in cross-examination you
17 were asked earlier about some planned nuclear plants in
18 France and Japan and just to follow up on that very
19 slightly. I take it that you are also aware that a
20 little over a year ago South Korea contracted for the
21 supply of a second CANDU 6 reactor.

22 MR. PENN: A. Yes, I am. I thought at
23 the time we were talking light water reactors and
24 that's why I omitted it.

25 Q. At the present time the Korean's and

1 AECL are negotiating for the supply of a third and
2 fourth CANDU 6 unit to South Korea?

3 A. That is correct.

4 Q. Mr. King, if we could turn, please,
5 to Volume 3 of our book tab 2. I have attached to the
6 interrogatory answer which is Interrogatory 9.7.60--

7 THE REGISTRAR: That becomes 520.42.

8 ---EXHIBIT NO. 520.42: Interrogatory No. 9.7.60.

9 MR. HAMER: Q. --an excerpt from overall
10 document which was attached to that interrogatory
11 answer, the overall document was Ontario Hydro's
12 Submission to the Hare Commission, and we have attached
13 in this tab too simply an excerpt dealing with the
14 safety implications of Chernobyl and Three Mile Island.
15 In that chapter could we turn, please, to page 10-9.
16 This is simply to complete our discussion late
17 yesterday on positive void reactivity, and I want to
18 direct your attention to the paragraph at the bottom of
19 the page that starts "It is worth noting..."

20 First of all, Mr. King, were you
21 involved in the preparation of this part of the
22 submission to the Hare Commission?

23 MR. KING: A. No, I was not.

24 Q. Are you familiar with the areas that
25 are dealt with in this excerpt that I take it you have

1 had an opportunity to review?

2 A. I haven't had an opportunity to look
3 at this particular page since you pointed it out, of
4 course.

5 Q. Well, let's just look at that
6 paragraph in which the authors at Ontario Hydro state:

7 It is worth noting that all water
8 reactor types can experience conditions
9 that will cause rapid positive reactivity
10 insertion. This can occur, for example,
11 in a pressurized water reactor due to
12 rapid reductions in reactor coolant
13 temperature or a failure that results in
14 the ejection of a control rod from the
15 pressurized core.

16 I take it from evidence yesterday that
17 you would agree with that statement thus far?

18 A. I believe yesterday I referred to the
19 case where you could have a reduction in reactor
20 coolant temperature and I was referring to, I think I
21 called it an over-cooling transient in the steam
22 generator which would initiate that.

23 With respect to the second part of the
24 sentence, the BWR -- no, sorry, I had talked about that
25 as well.

1 Here they talk about a turbine trip.

2 I guess this is the third part of the
3 sentence.

4 Q. Yes, we actually haven't got to the
5 third part.

6 A. The second part, the injection of a
7 control rod, I didn't talk about that because that's
8 not related to the void reactivity coefficient that we
9 were talking about but still it is another why to
10 introduce positive reactivity into an LWR core.

11 Q. And then to carry on with the
12 sentence:

13 In a boiling water reactor due to
14 coolant void collapse during the
15 over-pressure transient following a
16 turbine trip or control rod ejection.

17 And you would agree that that is a
18 possible way in which rapid positive reactivity can be
19 inserted, or those are ways, rather?

20 A. Well, yesterday I was referring to
21 the containment isolation valve closure in a BWR, it's
22 essentially the same thing as a turbine trip, it is
23 just that the value of is a little further downstream
24 towards the turbine but it still causes a positive
25 reactivity insertion into a BWR.

1 Q. Just to take it away from your
2 testimony yesterday, to move away from that, you would
3 agree this these mechanisms set out in this document
4 are also mechanisms by which rapid positive reactivity
5 can be inserted into a boiling water reactor?

6 A. I guess I can't speak to the word
7 rapid.

8 From a conceptual point of view that
9 certainly does happen. What is rapid and what's not
10 rapid, I think we have to set some bounds on that
11 before we talk about that.

12 [10:15 a.m.]

13 Q. All right. Well, let's take out the
14 word rapid and say that you can agree that positive
15 reactivity can be inserted in a boiling water reactor
16 due to those mechanisms. You would agree with that?

17 A. Yes. And why I brought up the fact
18 rapid, it's not that I disagree with the word rapid
19 it's just that it's not my particular area. I'm aware
20 of the concepts but not all the relative speeds of all
21 the different insertion rates for all the different
22 reactors around the world.

23 Q. Then dropping down a few lines, the
24 sentence reads that:

25 These mechanisms exists... should read

1 really exist...is merely a reflection of the fact
2 that changes in reactor conditions that
3 in one direction will cause a safe change
4 in reactivity will, in the other
5 direction, cause an unsafe change in
6 reactivity.

7 And that is a fair observation; is it
8 not?

9 A. That's correct.

10 Q. All right.

11 DR. CONNELL: I am going to need a little
12 help understanding this. In the context of this
13 paragraph, are we to assume that the rapid positive
14 reactivity insertion is an undesirable event?

15 MR. KING: It's a characteristic of a
16 reactor type. Of course you would like your reactivity
17 coefficients to be all small and then it's easier to
18 control the reactor, but the --

19 DR. CONNELL: Sometimes you do want
20 positive reactivity insertion.

21 MR. KING: That's how you increase the
22 power of a reactor under normal control.

23 DR. CONNELL: Right. But you prefer that
24 to be moderate rather than rapid?

25 MR. KING: It allows for an easier

1 control of the reactor power.-

2 DR. CONNELL: And the implications of the
3 last sentence you looked at, that is, the contrast of
4 the safe change and the unsafe change, is that intended
5 to convey to us that the ability to shut down rapidly
6 also carries with it the risk of powering up rapidly;
7 is that the gist of it?

8 MR. KING: I don't think this last
9 sentence here refers to rates, it refers to directions
10 of change - and if I could just read it again - and the
11 words safe and unsafe are in parenthesis, so they were
12 just talking about increases or decreases.

13 I don't think they meant safe or unsafe
14 in any absolute, or an always inherently negative sort
15 of meaning to those words, to the unsafe word.

16 MR. HAMER: Q. If I might interject, Dr.
17 Connell, I don't know if it will assist or not.

18 But, Mr. King, if we could just expand a
19 little bit on that last sentence. It goes back to
20 something you said yesterday; does it not, in that in
21 the light water reactors increased density in the water
22 can cause positive reactivity and some of these
23 accident conditions cause the density of the water to
24 increase; is that fair?

25 MR. KING: A. Well, perhaps it would be

1 clearer, Dr. Connell, if I maybe went into a little
2 more detail than yesterday on this coolant density
3 reactivity coefficient that we were talking about.

4 Q. Could you just give me an answer to
5 that question, then I'll step back.

6 A. Could you ask it again, please.

7 Q. Yes. In the light water reactor, if
8 the density of the water is caused to increase, that
9 will cause an increase in reactivity, a positive
10 reactivity?

11 A. That is correct.

12 Q. Whereas in a heavy water reactor, it
13 is a reduction in the density of the water which causes
14 positive reactivity.

15 A. That is correct.

16 Q. So that you can have accidental
17 conditions in a light water reactor which cause the
18 density of the water to increase and, therefore, the
19 reactivity to increase?

20 A. Yes.

21 Q. And in a heavy water reactor, you can
22 have accidental conditions which cause the density of
23 the water to decrease and the reactivity to increase?

24 A. Yes, I believe that's all consistent.

25 Now, the times that -- the various conditions that a

1 reactor is in, whether it's equilibrium fuel
2 conditions, or start-up conditions, some of these
3 parameters and values of reactivity coefficients
4 change, so generally I have been referring to
5 equilibrium fuel conditions.

6 Q. And the important point, or one of
7 the important points, as I understand it, is that the
8 designer has to recognize in each type of reactor the
9 presence of this effect, either negative or positive
10 void coefficient, and make provision for the presence
11 of that characteristic?

12 A. Yes.

13 Q. Now, I'll back out. I don't know
14 if --

15 A. I was just going to mention, Dr.
16 Connell, is the reason why there's a positive
17 reactivity effect when you have a lowering density of
18 coolant within the pressure tube --

19 DR. CONNELL: You are speaking of the
20 CANDU now?

21 MR. KING: Of the CANDU, yes. Is that
22 the you are hence removing heavy water. As the density
23 goes down you are removing heavy water molecules from
24 within the pressure tube.

25 The heavy water molecules provide a

1 slowing down function which is important, that's the
2 moderation that is occurring - the slowing down of
3 neutrons is what the word moderator and moderation is
4 referring to - but as the neutron is bouncing off these
5 heavy water molecules it's slowing it down,
6 occasionally they will be absorbed, and that's a thing
7 you don't want to happen because you are losing that
8 neutron and it's not available for fission.

9 So when the density of the heavy water
10 coolant goes down, the number of neutrons absorbed goes
11 down because there are less heavy water molecules
12 around.

13 Also the slowing down of the neutrons,
14 which mainly occurs in the moderator but also occurs in
15 the heavy water -- in the heat transport system, the
16 slowing down doesn't slow down the neutrons as much
17 because you are removing some of those heavy water
18 molecules because of the lowering density.

19 But the CANDU reactor is an over
20 moderated reactor, that means we have slowed the
21 neutrons down more than we really need to, to find the
22 optimum, what's called a spectrum, that's the number of
23 neutrons which are at a certain energy level.

24 There is an optimum energy spectrum of
25 neutrons which will cause the highest number of nuclear

1 fissions. In fact, we are not at the optimum, we are a
2 little slower than the optimum, and since if we have a
3 lowering density in the coolant, it brings us closer to
4 the optimum and, hence, we create more fissions.

5 So we have created more fissions by
6 having a harder, more optimum spectrum, and we have
7 created more fissions because we don't absorb neutrons
8 because we have taken some of that water away and,
9 hence, the reactivity of the reactor increases and
10 power increases.

11 DR. CONNELL: Thank you very much. I
12 think this paragraph would be entirely luminous if I
13 could just ask one more question, that is, with respect
14 to the ejection of the control rods.

15 In the two references to ejection, is
16 this in fact accidental ejection that is being cited?

17 MR. KING: Yes. The difference between a
18 CANDU reactor and a light water reactor is the CANDU
19 reactor the normally inserted control rods, these are
20 not shutdown rods, these are the reactors which are
21 normally inserted in the core, in the CANDU reactor
22 they are inserted in the moderator which is low
23 pressure and they are inserted from above and there's
24 nothing that can force them out.

25 In a light water reactor you are

1 inserting these control rods either from above, but in
2 a boiling water reactor they are inserted from below
3 into a pressure vessel, a high pressure vessel which
4 has the core correspondence and has the heat transport
5 water and moderator water all in this one vessel and
6 it's at very high pressure, and it can in fact, through
7 this high pressure, eject some of the normally inserted
8 control rods out through their penetrations through the
9 vessel, and by removing a control rod from the core, at
10 say positive reactivity insertion, because the purpose
11 of control rod is to absorb neutrons.

12 DR. CONNELL: Which could raise the
13 pressure the more you eject?

14 MR. KING: That's a positive reactivity
15 insertion and that increases power.

16 DR. CONNELL: Thank you.

17 MR. HAMER: Q. And, Mr. King, while this
18 may seem to be rather deep science, the significance of
19 it is that while we pointed out a number of differences
20 between the Chernobyl reactor and the CANDU reactor
21 yesterday, one of the common characteristics is
22 positive void reactivity; correct?

23 [10:25 a.m.]

24 MR. KING: A. That's correct.

25 Q. The importance of that from the point

1 of view of assessing the significance of Chernobyl for
2 Ontario Hydro's reactors in one area is that the design
3 of the CANDU is much stronger to deal with the presence
4 of that positive void reactivity?

5 A. Yes. As I we have discussed in
6 evidence in chief and as we went over yesterday, the
7 design of our shutdown systems with respect to
8 capability, rate of insertion, independence and from
9 the process systems and independence from each other
10 where we have two shutdown systems, are all designed to
11 provide a very strong protection against any positive
12 reactivity insertions into the core where it's by void
13 coefficient or any other.

14 Q. Just to finish up on the physics and
15 engineering of Chernobyl, I see higher on that page in
16 the second full paragraph, if you look in the second
17 sentence they are referring to the fact that the
18 operators were operating contrary to the established
19 practices and they say:

20 This was a consequence of the fact
21 that the designers, while recognizing the
22 unsafe potential when the reactor is
23 operated below 20 per cent full power,
24 relied solely on rationale conformance
25 with operating procedures to provide

1 adequate safety. This low power range
2 was designated as a forbidden operating
3 region but no automatic features were
4 provided to assure safety.

5 Would that be in conformance with your
6 understanding of the operating conditions which were in
7 place at the time of the accident?

8 A. When this document that we are
9 looking at was written in August 1987, which is just a
10 year or so after the incident occurred, this would have
11 been the understanding of what happened.

12 As I referred to yesterday, there has
13 been new information that has come out, and I think I
14 was referring to the shift of blame between operators
15 and designers, and this international meeting with
16 Soviet representation in Vienna which is trying to put
17 out a new document which gives the latest information
18 on what happened in Chernobyl from a reactor design
19 point of view and from an operations point of view, is
20 that this power range below 20 per cent power, 700
21 megawatts thermal, it was in fact not a prohibited
22 range. Where it says here -- at this time everybody
23 thought it was, but I guess something got lost from the
24 translation from the Russian documents to at this time.

25 It was a range which the safety systems

1 were not capable of handling possible occurrences in
2 that range. It should have been a prohibited range,
3 the safety systems should have been designed to even
4 cater for being in a range and eventualities that could
5 occur, but the fact of the matter, I think the current
6 understanding is that it wasn't a prohibited range.

7 Q. So it wasn't the operator's fault
8 then at all on that point?

9 A. Yes, I think this is where, as I was
10 referring to yesterday, a bit of the shift of the blame
11 has moved from the operator to the designer with
12 respect to this particular aspect of the accident.

13 Q. Once again, one of the important
14 points for comparisons with CANDU is that the safety
15 shutdown systems have to be capable of covering all
16 operating conditions, and that's what the CANDU design
17 does much more effectively than the Soviet reactor at
18 Chernobyl?

19 A. We very rigorously looked at all the
20 possible operating configurations you possibly get into
21 and analyze the various things that could happen from
22 those operating conditions.

23 We would not have been in the same
24 situation as they found themselves in here with a
25 shutdown system which couldn't handle being in that

1 particular operating condition.

2 Q. Dr. Whillans, let us move on to the
3 health effects of Chernobyl. If we turn to our Volume
4 2, tab 12.

5 Dr. Whillans, you referred in chief, I
6 believe, to the International Chernobyl Project which
7 was a group of qualified experts sent to the Ukraine
8 some period of time after the accident to assess the
9 health effects on certain portions of the population
10 affected by the accident; is that correct?

11 DR. WHILLANS: A. Yes, it is.

12 Q. And you have had an opportunity to
13 review this document at tab 12 as being the overview of
14 the results of that study?

15 A. That's right. There is a much larger
16 report with the details.

17 Q. And that's the kind of report that
18 you would be very interested in your area and you are
19 familiar with it?

20 A. I am certainly interested and I am
21 generally familiar with it.

22 MS. PATTERSON: We are noting there is no
23 date on this either.

24 MR. HAMER: Well, I have just been told
25 what my first question should be.

1 Q. When was this report done?

2 DR. WHILLANS: A. The results were
3 presented at a conference in Vienna in May 1991, I
4 believe. The report may have been available a bit
5 sooner.

6 THE CHAIRMAN: We should give this an
7 Exhibit No.

8 MR. HAMER: I was just going to ask, Mr.
9 Chairman.

10 THE REGISTRAR: No. 560.

11 ---EXHIBIT NO. 560: The International Chernobyl
12 Project, An Overview, Assessment of
13 Radiological Consequences and Evaluation
14 of Protective Measures. Report by an
15 International Advisory Committee.

16 MR. HAMER: Q. If we go to the first
17 page inside the cover sheet we see the preface by the
18 chairman of the Committee which prepared this report.
19 And it is correct that the International Advisory
20 Committee was composed of prominent experts in
21 different field called together by various
22 participating organizations of the United Nation System
23 and the Commission of the European Communities?

24 DR. WHILLANS: A. Yes. And I think at
25 the back we see on the very last page the list of the
various experts who were members of the committee and
advisers to it; is that correct?

1 A. Yes.

2 Q. Including Professor Jovanovich from
3 the University of Manitoba?

4 A. Yes.

5 Q. And if we could go to a few passages
6 in this report. We see on the next page, the first
7 page of chapter 1 in the left-hand column, towards the
8 bottom of that column:

9 The International Chernobyl Project
10 was thus arranged with the participation
11 of the Commission of the European
12 Communities, the Food and Agricultural
13 organization, The International Labour
14 Office, the United Nations Scientific -
15 that's UNSCEAR - The World Health
16 Organization and the World Meteorological
17 Organization.

18 Those are the organizations involved;
19 correct?

20 A. Yes.

21 Q. And on the right-hand column we see
22 that the World Health Organization had sent a team of
23 experts as well as the League of the Red Cross and the
24 Red Crescent Societies. And the final report of the
25 World Health Organization this organization concluded

1 inter alia that:

2 Scientists who are not well versed in
3 radiation effects have attributed various
4 biological and health effects to
5 radiation exposure. These changes cannot
6 be attributed to radiation exposure,
7 especially when the normal incidence is
8 unknown, and are much more likely to be
9 due to psychological factors and stress.
10 Attributing these effects to radiation
11 not only increases the psychological
12 pressure in the population and provokes
13 additional stress-related problems, it
14 also undermines confidence in the
15 competence of the radiation specialist.
16 Is that your general understanding of the
17 finding of the WHO expert group?

18 A. In general, yes. I am not familiar
19 in detail with the WHO report but that is the general
20 finding of the most of these major studies.

21 Q. And that is one of the findings
22 coming out in the literature, is it not?

23 A. Yes, it is.

24 Q. And the Red Cross and Red Crescent
25 Societies concluded a little further down on that

1 column:

2 Among the health problems reported it
3 was felt that many of these, though
4 perceived as radiation effects, both by
5 the public and by some doctors, were
6 unrelated to radiation exposure. Little
7 recognition appears to have been given to
8 factors such as improved screening of the
9 population and changed patterns of living
10 and of dietary habits. In particular,
11 psychological stress and anxiety
12 understandable in the current situation
13 cause physical symptoms and affect health
14 in a variety of ways.

15 Again, they came to a similar conclusion
16 on the misperception of the causes of some of the
17 health effects.

18 A. Yes. I think it might be more
19 accurate to say these effects were not directly related
20 to radiation exposure.

21 Q. In a physical sense?

22 A. In a physical sense, yes.

23 Q. And just to step back from those two
24 conclusions for a moment. It's my understanding that
25 there were reports in the popular press at times that

1 members of the population in the Chernobyl area were
2 found to have solid tumors appearing shortly after the
3 accident. Are you familiar with those reports?

4 A. Yes, I think particularly the thyroid
5 tumors were mentioned.

6 Q. Would you agree with me that at the
7 time of those reports, very shortly after the accident,
8 it's well recognized that solid tumors simply do not
9 develop in that short a time?

10 A. That's certainly the consensus
11 derived from all the other evidence to date about
12 radiation effects, yes.

13 Q. And then over at page 3 we see on the
14 right-hand column in the second full paragraph in that
15 column, a description of the districts in the USSR that
16 were studied by the group, and to summarize that
17 description am I correct that the project group looked
18 at what are known as the contaminated areas, which are
19 areas of relatively heavy contamination outside the 30
20 kilometre exclusion zone around the reactor at
21 Chernobyl?

22 A. Yes, I think I made that distinction
23 in my own evidence.

24 Q. All right. And the vast majority of
25 the population had been evacuated from the 30 kilometre

1 zone; correct?

2 A. Yes.

3 Q. And they had been evacuated very
4 shortly after the accident and were therefore removed
5 from the source of the radiation?

6 A. From the contamination that was still
7 present, yes. Some of these people did receive
8 exposures during the early days before they were
9 evacuated.

10 Q. That's my point. But these exposures
11 stopped when they were evacuated assuming that they
12 were evacuated to non-contaminated zones?

13 A. Yes.

14 Q. Whereas the populations living in the
15 contaminated zones had continued to receive dose from
16 the contamination in those areas, and one of the
17 purposes in this study was to come up with some
18 reliable evidence as to whether there was cause for
19 large concern concerning the continued presence of
20 those people in relation to the continuing dose. Very
21 long sentence, but do you agree with it?

22 A. Yes, I think so. I think this
23 project was what I would probably call a scoping
24 project. It looked at many things besides dose to the
25 population, and within the area of health effects, that

1 is true. It was looking at whether or not it was
2 likely that they should be concerned about health
3 effects in this population, and did not include in
4 terms of its reference the other population which had
5 been evacuated, that's true.

6 Q. Nor did it include the military
7 personnel who had been brought in to deal with the
8 immediate effects of the accident?

9 A. That's also true.

10 Q. And again those persons were not left
11 exposed to continuing doses at the reactor site; they
12 were brought in and then they were taken out, although
13 they received high short-term doses while they were
14 there.

15 A. And it is possible that they also
16 were contaminated internally and would continue to
17 receive doses, but that wouldn't be the major source, I
18 would think.

19 Q. I think that sets one of the
20 important parameters this study. If we can go then to
21 page 16 under the heading General Conclusions. In the
22 pages leading up to this the authors have been
23 discussing the levels of contamination found, and if we
24 look at the second paragraph there we see that their
25 general conclusion was:

1 The concentrations of radionuclides
2 measured in drinking water and in most
3 cases in food from the areas investigated
4 were significantly below guideline levels
5 for radionuclide contamination of food
6 moving in international trade and in many
7 cases were below the limit of detection.
8 And that's your understanding of their
9 conclusion?

10 A. Yes.

11 [10:40 a.m.]

12 Q. And some of the initial reports had
13 raised very serious alarm concerning contamination of
14 food and drinking water in widespread areas; had they
15 not?

16 A. Yes. I think a lot of that alarm
17 arose because radiation is detectable at very low
18 levels and radioactive is detectable at very low levels
19 and was detectable in much of Europe, in North America
20 for that matter, but the levels were very low and much
21 below, as it says, the guidelines that are set for
22 contamination of food.

23 Q. One of the features of radiation
24 protection is that unlike many other toxic substances,
25 we have unbelievably precise measuring instruments that

1 are able to detect tiny, tiny quantities of the
2 contaminant; isn't that so?

3 A. Yes. I'm not sure it's unbelievable.

4 Q. Well, that was a bad choice of word.

5 A. Yes. We can detect very, very low
6 levels.

7 Q. To somebody who didn't know anything
8 about this, it might be unbelievable.

9 A. Right.

10 Q. If we go over then to page 22, the
11 authors discuss their study of the effects on the human
12 population, and in the right-hand column we see that:

13 About 9,000 people were monitored
14 for internal irradiation in mid-1990
15 using a mobile laboratory.

16 That's your understanding as well?

17 A. Yes. I'm not sure just what goes
18 before this section, but there were monitors set up in
19 the area, there were also people monitored in other
20 countries including Canada who had come from that area,
21 who had been in that area during the exposures.

22 So there's quite a lot of information
23 about monitoring of internal contamination, and this
24 may well be the reasonable number for how many were
25 done in that area.

1 Q. All right. And the finding was that:

2 The results of the whole body
3 measurements (irradiation) indicate
4 little relationship between the amount of
5 caesium ground contamination and
6 the amount of caesium in the body.

7 A. That's what it says, yes.

8 Q. What's the significance of that; do
9 you know?

10 A. Well, I presume it means that there
11 are burdens of caesium, low level burdens of caesium in
12 everyone because Chernobyl is not the only source of
13 it, weapons testing, various other sources. For this
14 population which was outside the prohibited zone, the
15 amounts found in their bodies varied for other reasons
16 than just the fact that they happened to be in a
17 certain area in the surrounding region.

18 Q. If we go back one page to page 20, we
19 see a bar chart at the top of the page, and it's my
20 understanding that the black bars indicate the Soviet's
21 official estimates of doses in the population or to the
22 population, and the white bars compare what the
23 international Chernobyl project found subsequently; is
24 that correct?

25 A. Yes, that's what it shows.

1 Q. And in all of the areas studied the
2 official estimates of doses received were in fact
3 higher than what the international team of experts
4 found subsequently; is that correct?

5 A. Yes, I think that's one of the major
6 conclusions of the report, that they found that the
7 Soviet's estimates of transport of activity to people
8 and the doses were conservative, overly conservative.

9 Q. And it's not a criticism, it's just
10 that the official estimates were conservative.

11 A. That's right. It's only a criticism
12 in the sense that these estimates are used as the basis
13 for actions such as evacuation, and these interventions
14 like evacuation should be done based on realistic
15 estimates to the extent possible.

16 Q. All right. Could we go then to page
17 24, and we see again a bar chart at the top of that
18 page breaking out external irradiation and internal
19 irradiation and, again, that chart shows; does it not,
20 that the original official estimates indicated by the
21 black bars were all higher than the international
22 experts' subsequent estimates?

23 A. Yes, and you can see in the middle
24 section that one of the major discrepancies was because
25 of the internal contamination by caesium.

1 Q. It was found to be far less.

2 A. It was estimated to be far less than
3 the original official estimates.

4 Q. And then if we go to page 25, the
5 next page, there is a table in the lower right-hand
6 column and that indicates that the ranges in the
7 estimates of 70-year doses arrived at by the
8 international team were as follows, and the external
9 dose was set out as being between 60 to 130
10 millisieverts; is that correct?

11 A. Yes, that's what it says.

12 Q. And that is the expert team's
13 estimate of the dose that would be received over a
14 normal lifespan of 70 years; is that correct?

15 A. That's right.

16 Q. And the internal dose estimated for a
17 normal lifespan from the time of the accident was 20 to
18 30 millisieverts for a total of 80 to 160
19 millisieverts?

20 A. That's right.

21 Q. I have been told that there is a
22 usual limit for annual dose of 5 millisieverts for
23 members of the public; am I correct about that?

24 A. In Canada and many other countries,
25 that is the current legal limit for public exposure

1 from, say, industrial sources of activity.

2 Q. If you took that 5 millisieverts and
3 multiplied it by 70 years, you would come to a total of
4 350 millisieverts lifetime dose; correct?

5 A. That's right.

6 Q. So that that puts the 80-160
7 millisieverts estimated as the lifetime doses for the
8 inhabitants of the contaminated areas into some kind of
9 context; correct?

10 A. Yes, it does. I have been puzzling
11 as you have been talking about the 80. I guess I
12 didn't look carefully enough at what areas were being
13 considered, but I would have thought that the range of
14 public doses went to virtually zero if it didn't
15 include the other sources from background.

16 In other words, I'm saying the 80 seems
17 high as a minimum dose and I'm not sure exactly what's
18 being referred to here. I'm just pointing out that
19 they give a range of total from 80 to 160
20 millisieverts. Now, I'm curious about what population
21 receives a minimum of 80.

22 Q. Well, if anything, that figure again
23 would be conservative?

24 A. Yes.

25 Q. Would it not?

1 A. Well, yes, yes. I mean, it's simply
2 a matter that they have looked at an area outside the
3 30-kilometre zone, but not all that much further.

4 Q. Yes.

5 A. Just in the surrounding areas I guess
6 where there is still significant contamination.

7 A lot of the estimates that are in the
8 press and other publications that talk about the sort
9 of total world collective dose, of course, include
10 populations that go much below 80, go virtually to a
11 normal background as you say, 35 or something like
12 that.

13 Q. All right. Could we turn then to
14 Chapter 4 at page 27 which deals with health impact,
15 and am I correct in understanding that the
16 international project group looked at certain
17 settlements within the contaminated areas and then used
18 as control groups settlements completely away from the
19 contaminated areas but with similar socio-economic
20 conditions?

21 A. I believe it says that somewhere
22 here, yes.

23 Q. Right. And then if we go to page 28,
24 we see a bar graph in the upper left-hand corner
25 dealing with different age groups from the age of 2 to

1 the age of 60; correct?

2 A. Correct.

3 Q. The white bars are the control
4 settlements which were studied away from the
5 contaminated areas, and the gray bars are the
6 settlements within the contaminated areas; correct?

7 A. Yes.

8 Q. We see that the percentage of the
9 population needing medical attention in the various age
10 groups is either the same in both groups or, except in
11 one case, the people in the contaminated areas were
12 slightly less in need of medical attention?

13 A. Yes, that's what it says.

14 Q. All right. And we see in the
15 explanation of that table underneath the bar graph in
16 italics, about eight lines down:

17 Independent medical examinations
18 of inhabitants of both surveyed
19 contaminated and surveyed control
20 settlements revealed no health disorders
21 that could be attributed directly to
22 radiation exposure but did indicate
23 significant non-radiation related health
24 disorders among the adult population.
25 As illustrated here, project results

1 indicated that 10 to 15 per cent of the
2 adult population examined in both
3 surveyed contaminated and surveyed
4 control settlements should be referred
5 to a physician for follow-up medical
6 care.

7 And that's what they found.

8 A. That's what it says. I mean, I
9 should point out that I really have no information
10 other than what I read in documents such as this or
11 similar reports and literature.

12 Q. I appreciate that, but as an expert
13 in health effects of radiation, part of your job is to
14 be familiar with the current literature and you rely on
15 current literature in coming to conclusions in your own
16 work; correct.

17 A. That's true.

18 Q. Then if we go to the opposite page
19 29, there are some more bar graphs comparing the
20 control to the contaminated settlements, and the one in
21 the left-hand column indicates roughly comparable
22 results for lymphocyte counts in the two groups;
23 correct?

24 A. Yes.

25 Q. What are the lymphocyte counts?

1 A. That's almost a medical question, but
2 lymphocytes counts are the concentrations or the
3 numbers of white blood cells, certain kind of white
4 blood cells which are related to health.

5 Q. In a way it's a measure of the body's
6 immune system?

7 A. Yes, in a way.

8 Q. And at the bottom of the description
9 on the left-hand column we see four lines from the
10 bottom:

11 The immune system of those examined
12 as judged from the lymphocyte level and
13 the prevalence of other diseases do not
14 appear to have been significantly
15 affected by the accident.

16 Correct?

17 A. Yes.

18 Q. And over on the right-hand side we
19 see about seven lines from the bottom in the
20 explanation of the other chart:

21 As illustrated here, independent
22 analysis using radio-immune assay methods
23 found no abnormalities in the thyroid
24 function of children 2 to 10 years old,
25 nor was there any statistically

1 significant difference between the
2 thyroid functioning of children examined
3 from the surveyed contaminated and the
4 surveyed control settlements.

5 Correct?

6 A. That's true for these populations,
7 yes.

8 Q. And we see in the chart that the
9 thyroid functions in both groups were well within the
10 normal range.

11 A. That's what it shows, yes.

12 Q. And thyroid function is one of the
13 important factors to be looked at in assessing health
14 effects of radiation exposure; fair?

15 A. Well, I think it's more important
16 from the point of view that radio-iodines are one of
17 the common nuclides that are emitted and so -- and they
18 affect primarily thyroid, and so this is an early sign,
19 if you like, of radiation impact on the population's
20 health. I think it's also important, particularly for
21 children, because the thyroid is involved in growth.

22 Q. Go over to page 32, please, to the
23 general conclusions on health impact, and the expert
24 team found, beginning at the top of the left-hand
25 column:

1 There were significant non-radiation
2 related health disorders in the
3 populations of both surveyed contaminated
4 and surveyed controlled settlements
5 studied but no health disorders that
6 could be attributed directly to radiation
7 exposure.

8 And that's your understanding of the
9 outcome?

10 A. Yes, it is.

11 Q. And then it goes on to discuss the
12 psychological effects we referred to earlier and then
13 it, in the next paragraph, indicates that, in effect,
14 that studies should continue, for example:

15 Reported absorbed thyroid dose
16 estimates in children are such that there
17 may be a statistically detectable
18 increase in the incidence of thyroid
19 tumors in the future.

20 And you would agree that that's a
21 phenomenon which should continue to be monitored?

22 A. Yes, I would.

23 Q. And then the final paragraph says:

24 On the basis of the doses estimated
25 by the project and currently accepted

1 radiation risk estimates, future
2 increases over the natural incidence of
3 cancers or hereditary effects would be
4 difficult to discern even with large and
5 well designed long-term epidemiological
6 studies.

7 [10:55 a.m.]

8 A. Yes, that's the conclusion for this
9 population. I think in my evidence I tried to
10 distinguish between this population and the others that
11 you referred to earlier this morning, which were more
12 highly irradiated and on which the current
13 epidemiological studies were focused.

14 Q. And we are waiting for the outcome of
15 those studies on the people of people that, (A), were
16 within the 30 kilometre zone, and (B) the military
17 people who went in to deal with the accident.

18 A. Yes, generally, yes. And as I
19 mentioned, there are, even with that population where
20 one might expect to find more health effects, there are
21 some significant problems in just getting the studies
22 done because of the record system and so forth.

23 Q. But would you agree with me that the
24 populations in these contaminated areas have been
25 continuing to receive the dose that comes from the

1 contamination over a longer period of time than the
2 evacuees from the 30 kilometre zone?

3 A. Yes.

4 Q. And the length or duration of
5 exposure is an important factor in considering health
6 effects of radiation?

7 A. Yes, that's certainly an important
8 factor.

9 Q. And the quantity of the dose is
10 important as well?

11 A. Yes. And the interaction of those is
12 the rate at which the dose is received, which is also
13 an important factor.

14 Q. The evacuees received more for a
15 shorter time than the people in the contaminated zones;
16 correct?

17 A. Generally true. I think as I said,
18 some of those evacuees use may have been contaminated
19 internally which means that they will continue to
20 receive some of their dose throughout their lifetime or
21 certainly for some fraction of it. But generally
22 that's true, most of their exposure, a higher
23 proportion of their exposure was received acutely, yes.

24 Q. Let me suggest this proposition to
25 you, and I know that it is only a very rough kind of

1 logic, but if one sees, in the populations in the
2 contaminated zones, less in the way of health effects
3 then perhaps originally people had been predicting, is
4 it not reasonable to expect as well that one may see
5 less in the way of health effects in the evacuees than
6 had originally been predicted?

7 A. Well, I think that may be too strong.

8 One of the reasons for the lower levels
9 of effects and dose I think in the population we have
10 been talking about here is because of the models the
11 Soviets use to estimate the transfer of activity to
12 population, and that really doesn't have to do with
13 health effects per unit dose.

14 There are other factors that have to do
15 with the ability to see significant differences when
16 they are small in a large population which varies more
17 than a small population would.

18 There are a number of factors. I guess
19 what I am saying is there are a number of factors and I
20 don't know that you would necessarily expect that
21 because of these over-estimates there would be similar
22 over-estimates in the nearby population.

23 Q. But you wouldn't be surprised to see
24 that in the long run when the further work is
25 completed?

1 A. I don't know that there actually are
2 any what I would call scientific estimates of health
3 effects in either population for that matter related to
4 cancers. And particularly in these people who received
5 higher doses, there is certainly an understanding that
6 they did receive higher doses, but because of latency I
7 don't think anyone really expects there to have been
8 many observable cancers, for example.

9 You were also talking about some
10 non-cancer effects such as thyroid function, and I
11 believe there have been measurements on, for instance,
12 children who were evacuated but I am not really
13 familiar with the results.

14 One of the problems in that area again as
15 I mentioned is that there aren't really good records of
16 what the population would have experienced if there
17 hadn't been a Chernobyl. The populations in
18 surrounding areas are used for reference but their
19 records are not good either.

20 Q. One of the epidemiological problems
21 is that cancer is a very common disease and a disease
22 of old age, and there are a great many cases of cancer
23 when one looks at the population through its whole life
24 span.

25 A. Yes. That's exactly one example of

1 why there is concern about the records. I think that
2 Soviets report a lifetime cancer incidence of 10 or 15
3 per cent, whereas in our part of the record the
4 incidence would be perhaps 30 some-odd per cent.

5 Q. Because we detect it better?

6 A. Well, it could be that. It could
7 just be a questioning of reporting. We have registries
8 where virtually all cancer cases in Ontario are
9 recorded. That's not common in third world countries
10 and other parts of the world.

11 Q. Now, if we go to page 33 we see in
12 the left-hand column about six lines down the
13 statement:

14 The vast majority of adults examined
15 in both the surveyed contaminated
16 settlements and the surveyed control
17 settlements visited either believed or
18 suspected they had an illness due to
19 radiation.

20 A. Yes.

21 Q. And that was a subjective perception
22 but it wasn't borne out by the study; correct?

23 A. Yes, that's correct.

24 Q. In objective terms.

25 A. Well, certainly what we just have

1 just read is that the study found no objective evidence
2 of any radiation directly -- of any health effects
3 directly related to radiation exposure.

4 Q. And there were health effects related
5 to psychological stress and anxiety; correct?

6 A. I believe that's true. That's
7 certainly the interpretation that reports such as this
8 make.

9 Q. And while you are not a physician,
10 you would agree that those who exaggerate the physical
11 effects of an accident like this do nothing to help of
12 the psychological anxieties and stress of the
13 population, wouldn't you?

14 A. I think you are right, that is a
15 medical question.

16 Q. And then over at page 35 we come to
17 the recommendations with respect to health effects and
18 the authors say in the left-hand column:

19 The adverse health effects of
20 relocation should be considered before
21 any further relocation takes place.

22 What that conclusion is directed to is
23 the fact that the health effects of the accident had
24 not been severe as subjectively believed, while on the
25 other hand relocating large populations itself incurs

1 health effects on the populations; correct?

2 A. That's true. Generally, and I think
3 I referred to the situation we have here where there
4 were three politically distinction groups that were
5 exposed in the Chernobyl area, and there was a lot of
6 suspicion about the motivation in relocating some
7 populations, and this added to the usual problems that
8 occur when you transport somebody to an entirely new
9 place.

10 Q. And what the authors of the report
11 were attempting to do was to allay concerns over
12 objective appearance of health effects, and in part to
13 attempt to alleviate some of the psychological stress
14 and anxiety that was current in the population?

15 A. I think the report was addressed
16 mainly to the population outside the Chernobyl area.
17 But certainly the first part of what you say is true,
18 it was attempt to give an objective view of what the
19 real effects were likely to be and to contrast it
20 perhaps with some of the earlier reports.

21 Q. Mr. Penn, you and I will now deal
22 with the table which I provided to you a day or two ago
23 concerning costs attributable to waste disposal and
24 plant decommissioning, if we may.

25 Ms. Findlay will pass out the table.

1 THE CHAIRMAN: Next Exhibit No., please.

2 THE REGISTRAR: 561.

3 ---EXHIBIT NO. 561: Document entitled, Waste Disposal
4 and Plant Decommissioning Cost
Sensitivities.

5 MR. HAMER: Q. Mr. Penn, what we have
6 done here is first on the second page of the little
7 handout, photocopied a page from Exhibit 519, being
8 overhead No. 81, correct.

9 MR. PENN: A. I recognize it. My copy
10 doesn't have page 81, but I take it that it is page 81.

11 Q. I can tell you that it is. And then
12 on the next page, we see a table setting out cost
13 sensitivities of the LUEC for nuclear power, the
14 sensitivity being to variations in the cost of
15 long-term fuel disposal; correct?

16 A. That's correct.

17 Q. And you have had an opportunity to
18 check the arithmetic here, have you not?

19 A. I looked it over and it seemed all
20 right to me.

21 Q. And basically what the table shows is
22 the effects of two kinds of variation in the cost of
23 fuel disposal, and the two right-hand columns, if fuel
24 disposal turns out to be twice as expensive as Hydro's
25 estimates used in the DSP or if it turns out to be five

1 times as expensive; correct?

2 A. I see that assumption, yes.

3 Q. And you accept that the base LUEC in
4 the left-hand column is taken from Exhibit 519, you
5 have had an opportunity to check that?

6 A. Well, they are referring to the
7 previous page in this exhibit, 561. I can confirm that
8 the Darlington type 4 by 881 does have a range of 3.7
9 to 4.3 cents per kilowatthour in 1991 dollars.

10 Q. And the other figures in that column
11 are similarly taken from your table?

12 A. Yes, they are, and they are correct.

13 Q. The other parameter is that Hydro
14 estimates fuel disposal cost at 1.2 per cent of the
15 base LUEC figures. We see that in note at the bottom
16 of the page; correct?

17 A. Yes. For a new nuclear station on a
18 levelized unit energy cost basis, page 62, I can
19 confirm, does indicate that disposal is 1.2 per cent of
20 the lifetime generation cost.

21 Q. So that the figures in the second and
22 third columns show, for example, that if fuel disposal
23 was twice as expensive as presently estimated, it would
24 cause the range of LUEC for Darlington type stations to
25 go from 3.70 to 4.30, up to 3.74 to 4.35; correct?

1 A. That is correct, yes. It would just
2 add another 1.2 per cent.

3 Q. Right. And again on the Darlington
4 example, if it was five times as expensive, the LUEC
5 would go to 3.88 to 4.51?

6 A. That's correct.

7 Q. And the effects on the CANDU 6 and
8 CANDU 9 examples are somewhat less proportionately; is
9 that correct? Not proportionately, absolutely they are
10 somewhat less? I.e., the range, if you double the cost
11 for the CANDU 6 option for fuel disposal moves from 4.0
12 at the bottom end the range to 4.05 at the bottom end
13 of the range; correct?

14 A. That's what the number shows.

15 Q. I guess that's not an absolute. In
16 absolute terms that's not a smaller increase, is it.

17 A. No. I was struggling with that
18 point.

19 Q. You are right.

20 In any event, we can agree that those
21 figures show that variations of this kind in fuel
22 disposal costs will have a very slight impact on
23 overall LUEC; correct?

24 A. Yes. And the reason is, of course,
25 that the disposal, final disposal of this fuel would be

1 occurring very far into the future, and that there
2 would be provisions during the lifetime of 40 years of
3 these plants to collect the money to do that.

4 Q. And it's a very low percentage of the
5 overall lifetime costs?

6 A. Yes, it's 1 per cent.

7 Q. Right. And similarly on the third
8 page of the handout we carry out the same exercise for
9 plant decommissioning, and that shows once again that
10 the effects of a doubling or a quintupling of the costs
11 of plant decommissioning would have minimal effects on
12 LUEC, far smaller than in the case of fuel disposal in
13 fact; correct?

14 A. That's quite correct.

15 Q. Could we look, please, at Exhibit
16 507, which is excerpted in my Volume 2, tab 8.

17 Do you have that?

18 A. Yes, I do.

19 Q. At the bottom of page 5-21, please.

20 A. Yes, I have that page.

21 Q. That passage summarizes, beginning at
22 the bottom of the page, the potential health effects --
23 and I'm sorry, I should be shifting from Mr. Penn to
24 Dr. Whillans at this point, I believe.

25 A. I thought you were going to test me

1 for a moment. [Laughter]

2 Q. No.

3 Dr. Whillans, this section of the report
4 summarizes overall potential health effects from the
5 nuclear generation operation; correct?

6 DR. WHILLANS: A. Yes, it does.

7 Q. If we go over to the top of the next
8 page we see in the first full paragraph that the total
9 risk estimated by Hydro on the basis of the preceding
10 sections in the report is 0.22 fatalities per gigawatt
11 annually; correct?

12 A. Per gigawatt-year, yes.

13 Q. And the portion of that risk
14 attributable to occupational risk is the vast majority
15 of the risk, about 80 per cent?

16 A. 80 per cent, yes.

17 Q. And then the largest contributor to
18 the occupation risk is radiation?

19 A. 70 per cent, yes.

20 Q. And of the radiation risk the largest
21 contributor both for occupational risk and public risk
22 is the operation of the power plants themselves;
23 correct?

24 A. Yes, that's correct.

25 Q. So that we can conclude from that

1 that it is only a minority or a small proportion of the
2 overall risk which is attributable to decommissioning
3 for one and long-term fuel disposal for another;
4 correct?

5 A. Yes. I think maybe a clearer
6 demonstration of that is in 5.1 on page 528 where the
7 actual numbers are summarized.

8 Q. Well, let's turn to that. I think
9 that's in the excerpt as well, isn't it?

10 THE CHAIRMAN: Page number, please?

11 MR. HAMER: I don't think it has a page
12 number but it's at --

13 DR. WHILLANS: The page number is on the
14 side of the page.

15 MR. HAMER: 5-28, on the side of the
16 page, Mr. Chairman. It's table 5-1.

17 THE CHAIRMAN: Thank you.

18 MR. HAMER: Q. I wanted to get an idea
19 from you, Dr. Whillans, just to how this table works.

20 I would like to start with public risks
21 in the right-hand side of the table.

22 DR. WHILLANS: A. Yes.

23 Q. And there is a sub column there
24 headed Conventional Accidents?

25 A. Yes.

1 [11:15 a.m.]

2 Q. If we go down we see the entry NE for
3 not evaluated for things like mining and milling and
4 fuel fabrication; correct?

5 A. Yes.

6 Q. And that's because members of the
7 public are not going to be involved in mining
8 accidents, for example, unless they also happen to be
9 miners?

10 A. I suppose that's true. I should
11 point out that in the early parts of this chapter
12 there's several paragraphs on each of these sections--

13 Q. Right.

14 A. --which discusses just that kind of
15 thing.

16 Q. Right.

17 A. And also the table 5.3 starting on
18 page 5-30 gives much more detail of the calculations
19 that go into each of these numbers.

20 Q. Right. Well, the only point I wanted
21 to get at here is, once we get past the NEs, am I
22 correct that one simply takes the figures, for example
23 .007 for transport of uranium materials, and sums them
24 to get to a risk total at the bottom of that
25 conventional accident column of 0.013?

1 A. That's correct.

2 Q. And then over on the next column
3 radiological accidents, one sums the figures there to
4 get to a total of 0.019?

5 A. Yes.

6 Q. And then on the right-hand normal
7 radiological exposures, one sums those figures to get
8 to a total of .021?

9 A. That is correct.

10 Q. And then adds those three figures to
11 get a total for public risks of 0.053 both conventional
12 and radiological? That's the second last line from the
13 bottom.

14 A. Yes, I see it. I'm looking at the NA
15 under conventional and I think we should probably refer
16 to the text to see the exact reason why that was not
17 applicable.

18 Q. Well, wouldn't the reason be that
19 conventional is non-radiological accidents?

20 A. Yes.

21 Q. So it's NA for not applicable. They
22 are mutually exclusive. You are looking at
23 radiological totals and conventional accidents are
24 going to --

25 A. Radiological total is .04.

1 Q. Right. So, the NA --

2 A. I'm sorry, I thought you had moved on
3 to the .053. Right, okay.

4 Q. Okay.

5 A. Yes. Oh I see. Of course, sure.

6 Q. So then the total public risk set out
7 in this table based on all the detailed analysis
8 earlier in the report is 0.053?

9 A. That's correct.

10 Q. And over on the left-hand side we see
11 under radiological risks, for example, there's a column
12 for accidents and a column for normal operations;
13 correct?

14 A. Yes.

15 Q. And the radiological risks there
16 under normal operations sum to 0.12?

17 A. Yes.

18 Q. And under accidental conditions sum
19 to 2 times 10 to the negative 9?

20 A. That's right. Much smaller.

21 Q. How many zeros would there be after
22 the decimal point?

23 A. Is this a trick question?

24 Q. Well, I can never understand what
25 those negative figures mean.

1 A. I guess there would be eight.

2 Q. Okay. So that gets cut out by
3 rounding anyway; doesn't it, when you add up to the
4 bottom?

5 A. Yes, it does.

6 Q. And you get to a radiological total
7 for workers of 0.12; correct?

8 A. Yes.

9 Q. And that gives you an occupational
10 total for both conventional accidents and radiological
11 exposures of 0.17?

12 A. Yes.

13 Q. I just want to go back actually on
14 that conventional accidents column under the
15 occupational heading.

16 A. Yes.

17 Q. If I add the figures in that column I
18 come to a total of 0.039 rather than 0.045. I wonder
19 if you can confirm that for me.

20 A. Well, we can certainly check that.
21 There may be some reasons explained, as I said, in the
22 detailed Table 5.3 why they don't add up, or it may be
23 some other reason. We can certainly check it.

24 Q. All right. Well, if you could give
25 me that undertaking perhaps after the break, you can

1 just let me know one way or the other.

2 So, in any event, you've got an
3 occupational total of 0.17, you add that to the 0.053
4 on the right and you get to the total of .22 that we
5 saw earlier in the text; right?

6 A. That one does add up, yes.

7 Q. All right. We will come back to that
8 a little later. If we could go to excerpts from the
9 Hare Report. I don't think I asked you about one
10 particular area at page 134, and this is tab 14 of
11 Volume 2 at page 134.

12 A. I have it.

13 Q. And Dr. Hare, up to paragraph 271,
14 has been discussing ALARA, the kinds of judgments that
15 one has to make in expending resources to achieve
16 greater safety, and he says in paragraph 271:

17 This kind of cost/benefit and
18 risk/benefit analysis can be quantified
19 and applied as a formal discipline.

20 And one of the ways in which that
21 analysis is carried out, as we discussed earlier, is by
22 looking at rough estimates of fatalities per
23 gigawatt-year; correct, that's one of the tools used in
24 that kind of analysis?

25 A. I suppose so.

1 Q. Well, you know that is so; don't you?

2 A. Well, the area of risk analysis, I
3 think, is one that maybe Mr. King would like to handle,
4 but I can agree generally that that would be one of the
5 numbers that we look at, yes.

6 Q. All right. And Dr. Hare says:

7 Doing so involves assigning values
8 to human life, health and injury in a
9 fashion unwelcomed to many.

10 And that's footnoted, and he says:

11 In Canada, the leading practitioner
12 has been Ernest Siddall. For a statement
13 of the philosophical position see
14 Siddall.

15 And you are aware that Ernest Siddall is
16 one of the leading practitioners of that discipline in
17 Canada?

18 A. From my general knowledge, that's
19 true, yes.

20 Q. Yes. And then Dr. Hare goes on to
21 say:

22 It - that's this formal discipline:
23 - also leads directly to a mechanism for
24 making comparisons with other modes of
25 energy production, or its avoidance for

1 energy conservation is in many ways a
2 form of production. Such choices
3 confront the province now.

4 And you would agree, again, from your
5 perspective as a health effects expert that it is
6 possible to devise or to compile data in relation to
7 various energy options and to make comparisons among
8 them?

9 A. I expect it's possible, yes.

10 Q. Yes. Well, again, you know it's
11 possible although you don't do it yourself.

12 A. That's right.

13 Q. And, for example, the formal
14 discipline can be used to assess, even as Dr. Hare
15 suggests, an energy conservation program.

16 A. Yes.

17 Q. To put it into context of your
18 discipline, if one were to institute an energy
19 conservation program which led to the sealing up of
20 houses without providing for adequate ventilation or
21 removal of radon from the neighbouring soil, one could
22 expect to increase peoples' exposure to radon?

23 A. Since you have qualified it today, I
24 agree with that, yes.

25 Q. Will you also agree with me that

1 probably for historical reasons Ontario Hydro has
2 traditionally devoted resources to risk analysis much
3 more in the area of nuclear generation than in any
4 other energy options which Hydro has been or is
5 becoming involved in?

6 A. I'm really not familiar with how much
7 analysis has been done for any of the other options.

8 Q. All right. I'm not asking about the
9 Demand/Supply Plan or this hearing, I'm just asking --

10 A. No, but I recognize that we have
11 people that deal primarily with fossil or demand
12 management and I really have no idea what level of
13 analysis is done in this area.

14 Q. All right. Do you, Mr. King?

15 MR. KING: A. Could you repeat the
16 question, please?

17 Perhaps before you do I can answer your
18 other undertaking. I was busily adding up some columns
19 here where they didn't add up.

20 Q. Perfect. Perfect.

21 A. The problem is that in table 5.2
22 under generation, that is a detailed breakdown of the
23 subsets of the generation. We were talking about in
24 table 5.1, occupational, conventional accidents column
25 and that was adding up to, as it is stated as 0.45 and

1 you couldn't come up with that addition.

2 In the table 5.2, that is broken down
3 into a further five numbers, breaking generation down
4 into construction operation, waste, used fuel.

5 Q. Right.

6 A. What has happened is that the person
7 preparing this table has added it up in this generation
8 under 5.2 and then rounded it off and the round off was
9 down.

10 Q. Under generation.

11 A. Under generation, and they brought
12 the rounded up number up here into the table 5.1, but
13 they went back and the total is really from the 5.2
14 table, if you add them all up. It's a round off
15 problem that came up.

16 Q. Okay.

17 A. In reality the number that it should
18 be in the generation row under occupational,
19 conventional accidents, rather than the 0.02 that's
20 there, it should be .0245 which is really the sum in
21 the table 5.2.

22 DR. CONNELL: But the person who rounded
23 it off may well have rounded it off because they did
24 not have confidence in the second and third significant
25 figure.

1 MR. KING: I would have difficulty having
2 confidence in the second and third. I think that is a
3 reasonable explanation.

4 DR. CONNELL: And so the total might
5 be --

6 MR. KING: No, but the total in self
7 though isn't the sum of the rounded off numbers, the
8 total is the sum of the numbers in table 5.2.

9 DR. CONNELL: I understand that, but it
10 might be best to regard that total as something like
11 0.04 plus or minus?

12 MR. KING: Yes. Anyway, I apologize for
13 not listening to your question while I was doing that.

14 MR. HAMER: Q. Well, I think we are
15 indebted.

16 Just to follow along on Dr. Connell's
17 question, is it correct, Mr. King, that what is
18 important in figures like this is to look and see
19 whether the risk is 1.0 as opposed to 0.001, those kind
20 of comparisons, rather than whether it's .012 or .018?

21 MR. KING: A. That's correct.

22 Q. And is that why I keep seeing the
23 expression, order of magnitude in some of this
24 literature?

25 A. Well, there may be other reasons why

1 you see that.

2 Q. But is that the right term?

3 A. There is uncertainty around
4 something, people are just giving an idea of the order
5 of magnitude of a certain value, certain parameter.

6 Q. Right, okay.

7 A. They are not claiming any two and
8 three decimal point accuracy.

9 Q. Right. Now, you made me lose my
10 place.

11 DR. CONNELL: It was whether there was
12 more risk analysis done for nuclear than other modes of
13 generation.

14 MR. HAMER: Oh yes.

15 Q. All right. I would like to turn next
16 to our Volume 3.

17 THE CHAIRMAN: Maybe we could take the
18 break. We are beginning to unravel here.

19 MR. HAMER: Sure.

20 THE REGISTRAR: Please come to order.
21 The hearing will recess for 15 minutes.

22 ---Recess at 11:30 a.m.

23 ---On resuming at 11:50 a.m.

24 THE REGISTRAR: Please come to order.
25 This hearing is again in session. Be seated, please.

1 THE CHAIRMAN: Mr. Hamer.

2 MR. HAMER: Q. Mr. King, I had asked
3 you, or perhaps it was Dr. Whillans, if it was not the
4 case that traditionally within Ontario Hydro the formal
5 discipline of risk analysis had been applied more
6 within the nuclear area of the corporation than in the
7 areas dealing with other supply options.

8 MR. KING: A. I would just like to first
9 clarify what is meant by risk analysis because perhaps
10 I think we use it a little different than the intent of
11 your question.

12 The risk analysis in the nuclear area,
13 there are large efforts resulting in some large reports
14 that I have referred to in my direct evidence which
15 look at the potential for serious accidents, and there
16 is certainly a lot of work going on in that area in the
17 nuclear field.

18 I take it that your question is referring
19 to the sort of information that was in the tables 5.1
20 and 5.2 in Exhibit 507, which we were just looking at
21 the numbers before the break. Is that correct?

22 Q. In part, yes.

23 A. The whole subject, I guess, of
24 comparative risk analysis, of looking at all the
25 impacts throughout a whole chain and then comparing the

1 sum of those with other technologies or other options
2 to do the same thing, that subject of comparative risk
3 analysis has been growing very rapidly over the last 10
4 years I would say.

5 Q. One of the areas - just to interrupt
6 for a moment - one of the areas where it first got
7 going was in the area of nuclear energy, though; was it
8 not, with Ernest Siddall and others like him?

9 A. Well, I think it was very broad
10 based. A lot of people started in the 70s. We
11 referred to a society of risk analysis which is now a
12 professional society which was formed in the early
13 1980s recognizing this new discipline of risk analysis
14 and it wasn't just a side bar of somebody else's
15 discipline, you actually spend, you know, you work
16 full-time in that field.

17 Q. Well, my information is that Earnest
18 Siddall, for example, one of the leading practitioners,
19 was at it in the 1960s.

20 A. He was at it in the 1950s.

21 Q. And he is an ex-AECL person; is he
22 not?

23 A. Yes, he is. He has written papers in
24 the mid-1950s where he is deriving safety criteria for
25 reactors based on comparing what a reactor performance

1 in the safety area should be compared to coal.

2 Q. Yes. My only point was that this
3 kind of analysis was practised in the very early stages
4 in the area of nuclear power generation as opposed to
5 other kinds of energy alternatives. It was people in
6 the nuclear industry who were among the pioneers in
7 this area.

8 A. Well, we are trying to sort out
9 what --

10 Q. In the area of comparative risk
11 analysis.

12 A. Well, if you are getting into
13 comparative risk analysis, you have to have something
14 to compare it against. In absolute risk analysis, yes.
15 I think the efforts in the nuclear area have led to
16 other options.

17 The area of comparative risk analysis
18 requires then that other technologies develop their
19 analysis in order to fill in the sort of boxes that we
20 saw on the figures 5.1, 5.2 of Exhibit 507.

21 Q. My point --

22 A. I think that the efforts in the
23 nuclear area and just the whole growth of the area of
24 comparative risk analysis have forced all sorts of
25 other technologies to be able to fill in those boxes.

1 Q. Right. And my point with respect to
2 Ontario Hydro was that the risks of nuclear were
3 analyzed more deeply earlier than were other
4 technologies in which Hydro has been involved?

5 A. Well, I have only been involved in
6 the nuclear side, I'm familiar with all of those. I
7 would say that is where my expertise is.

8 I was speaking in the last few minutes of
9 a general discussion of all sorts of hazardous
10 technologies.

11 Q. But you would agree with me that
12 within Ontario Hydro the analysis of the risks relating
13 to nuclear has gone much deeper than in areas such as
14 hydraulic generation or fossil generation, as far as
15 you know from your perspective within the nuclear area?

16 A. Well, my perspective in the nuclear
17 area is primarily in the area of accidents and I can
18 certainly confirm there that I believe that our
19 analysis for the public health effects due to
20 accidents, that nuclear is probably leading the way in
21 the type of risk analysis that is done, yes.

22 [12:00 p.m.]

23 Q. Are you aware of whether Ontario
24 Hydro has devoted any personnel or resources, for
25 example, to similar analysis in the fossil area?

1 A. The same area as you are talking
2 about is what I just prefaced my remarks regarding
3 accidents, public effects of accidents.

4 I am not aware of large efforts.

5 Q. What about health effects in general
6 in the fossil area?

7 A. That is beyond my expertise.

8 Q. Is it beyond your knowledge?

9 THE CHAIRMAN: You are aware, I take it,
10 Mr. Hamer, that Hydro put in a paper on the health
11 effects of fossil generation. It's an exhibit in this
12 hearing. There was, if my recollection is correct, a
13 discussion of this in Panel 8.

14 MR. HAMER: I wasn't here for Panel 8, so
15 I stand corrected, Mr. Chairman.

16 Q. In its normal operations may I take
17 it that Ontario Hydro has more in the way of resources
18 devoted to safety and health effects analysis in the
19 nuclear area than in the fossil area?

20 MR. B. CAMPBELL: I'm sorry, are we
21 talking occupational or public here, or generally?

22 MR. HAMER: Q. Both.

23 MR. KING: A. Again, I prefaced my
24 previous remarks to the accidents, public, and in those
25 areas, yes, we have a large number of people working in

1 the nuclear side and I have no doubt that that's higher
2 than in any other area. That's where my expertise is
3 and that's where I know definitely what is going on.

4 DR. CONNELL: Mr. King, if I could just
5 ask you to take a very broad look at it for a moment.
6 Let's suppose you were put in charge of all risk
7 avoidance and risk protection for Ontario and you had a
8 billion dollars to spend over the next 10 years, and
9 you had to think about fires and floods and tornadoes
10 and earthquakes and famine, as well as nuclear
11 accidents, would you be inclined to spend any part of
12 that billion dollars in incremental expenditures on
13 enhanced nuclear safety, or do you think the other
14 claims on that fund would take precedent?

15 MR. KING: If the object is to save
16 public lives, then you would probably spend all of that
17 have somewhere else, you are talking incremental, given
18 that you maintain the level that we are spending right
19 now.

20 DR. CONNELL: Thank you.

21 MR. HAMER: Q. Could we turn now to
22 Volume 3, tab 3.

23 Mr. Penn, you may be able to assist us on
24 some of the questions arising out of this document.

25 This is the Executive Summary of the

1 Helsinki Senior Expert Symposium on Electricity and the
2 Environment held in May of 1991.

3 MR. PENN: A. That's correct.

4 Q. I think we see some of the reports
5 coming out of that symposium referred to at various
6 points in Hydro's Panel 9 materials; is that correct?

7 A. That's correct. We had staff attend
8 that symposium.

9 Q. All right. Mr. Penn, from some of
10 your earlier evidence I understand you to have
11 considerable exposure to what is going on in the world
12 outside Canada in relation to nuclear energy; is that
13 fair? You visit Georges Moynet?

14 A. I think that's reasonably fair, yes.

15 Q. Are you familiar with the Executive
16 Summary of the Helsinki Symposium, you have had an
17 opportunity to review it?

18 A. I have read it, yes.

19 MR. HAMER: I wonder if that might be
20 marked.

21 THE REGISTRAR: 562.

22 ---EXHIBIT NO. 562: Senior Expert Symposium on
23 Electricity and the Environment,
24 Helsinki, Finland, 13-17 May 1991,
Executive Summary.

25 MR. HAMER: Q. The symposium was

1 organized as we see in the preface by the Commission of
2 the European Communities, the Council for Mutual
3 Economic Assistance, the International Atomic Energy
4 Agency, the International Energy Agency, and various
5 other world bodies; is that correct?

6 MR. PENN: A. That's correct.

7 Q. And it brought a broad range of
8 disciplines to bear on the question of electricity and
9 the environment?

10 A. Yes, it did.

11 Q. I would like to review with you some
12 of their conclusions and ask you whether you would
13 agree from your experience in the area of nuclear
14 energy with these conclusions.

15 If we look at page 7 of the Executive
16 Summary, we see the third key issue or finding relates
17 to efficiency improvement throughout the electricity
18 sector from generation to end-use, and it said that
19 that has a substantial potential to reduce impacts and
20 should be pursued vigorously.

21 And you are aware that Ontario Hydro is
22 proposing to do that, too?

23 A. Yes, it is, and most other major
24 utilities in the world are also pursuing that.

25 Q. And then if we drop down two

1 conclusions, these bodies found that the electricity
2 sector can make significant contributions towards a
3 reduction in future environmental impacts; correct?

4 A. That's correct.

5 Q. And then at the top of the next
6 column, the most stringent global targets, e.g. those
7 determined at the Toronto conference in 1988 for
8 reducing CO(2) emissions cannot be met by the
9 electricity sector without socially and economically
10 unacceptable curtailments in electricity services in
11 many countries.

12 You recognize that as a priority for
13 Ontario Hydro; namely, the reduction of CO(2), but
14 recognize as well that it is difficult to do both?

15 A. Well, I think what this conclusion or
16 key issue finding is referring to is that there are
17 some sectors and countries in the world that rely upon
18 fossil generation in particular for providing their
19 electrical services.

20 I think what this paragraph is saying is
21 that to meet the stringent global targets set in the
22 Toronto conference in 1988 for reducing CO(2)
23 emissions, that there are some areas in the world
24 that - in fact, it says in many countries at the end
25 that have paragraph - that it could cause socially and

1 economically unacceptable curtailments. I think that
2 is the sense of this, as I understand it.

3 Q. Let's pass on to a conclusion on page
4 8 relating nuclear power. At the bottom of the
5 left-hand column the conclusion is set out:

6 Nuclear power is the most likely
7 non-fossil energy source which can be
8 deployed on a much larger scale and with
9 costs competitive with fossil fuels for
10 base load generation. Nuclear energy has
11 therefore the potential to make a
12 significant contribution towards a
13 reduction in carbon emissions.

14 I will read the rest of the sentence, but
15 that far you would agree with that conclusion, I take
16 it, from your earlier evidence?

17 A. If I remember when I read the
18 article, I think this is relative to other alternative
19 energy sources and I would agree.

20 Q. Well, it seems to be directed to base
21 load generation.

22 A. Yes, I can see that. I would agree
23 that those countries that were able through their
24 infrastructure to use nuclear power in the future,
25 that, yes, it's likely that on average nuclear power is

1 competitive with fossil fuels for that purpose.

2 Q. And it has a potential to make a
3 significant contribution towards a reduction in carbon
4 emissions?

5 A. Yes, because nuclear energy, as we
6 all know doesn't emit the carbon dioxide.

7 Q. And then to finish the sentence:

8 But its social acceptability remains
9 in question.

10 And that is the major problem that
11 nuclear power faces, is it not?

12 A. It's one of the problems, yes.

13 Q. A major one?

14 A. It is a major one, yes.

15 Q. And then just in the commentary under
16 that conclusion at the top of the right-hand column,
17 five lines down, the statement is made:

18 Technology advances are being made to
19 improve the already good performance of
20 existing reactor technologies to develop
21 advanced reactors with passive safety
22 features and to provide the means for
23 better management of wastes. These
24 advances would help to improve public
25 acceptance of increased deployment of

1 nuclear power. Attitudes towards nuclear
2 energy will also be influenced by social
3 and environmental concerns about other
4 energy sources.

5 I would take it from some of your earlier
6 testimony that you will agree with those observations
7 as well?

8 A. I agree with most of it.

9 The implication here is that the public
10 would find greater acceptability for the further
11 deployment of nuclear power if we were to develop
12 advanced reactors with passive safety features. There
13 is, and I pointed out in my direct evidence, a
14 divergence of views on that subject.

15 I might point out that CANDU reactors
16 have always used passive features to a degree. But I
17 recall discussing this subject of relying on passive
18 features in Paris recently with EDF, and their view for
19 example, is that proven active systems have been very
20 reliable, and that is one utility, one country, that
21 would tend to build on what is called evolutionary
22 reactors as opposed to passive.

23 On the other hand, there are views in
24 Italy and Sweden and to some extent in the United
25 States that favours the development of passive systems.

1 So, with that caveat, I agree with the
2 general thrust of this.

3 Q. I would take it from that that you
4 would not favour discontinuing the existing CANDU
5 technology altogether and moving on to something
6 entirely new. You would favour more in the way of
7 evolution of the existing CANDU technology; is that
8 fair?

9 A. I certainly have the view that an
10 evolution of CANDU technology is advantageous to our
11 society, if that answers your question.

12 Q. Yes. If one were to allow the
13 technology to lapse, you would have no evolution;
14 correct?

15 A. Well, I think that is a question of
16 degree.

17 We have in Ontario already a large
18 existing nuclear program which will maintain level of
19 expertise in a whole range of areas.

20 So, I'm not sure that I am able to judge
21 whether a lapse of a few years would be significant or
22 not.

23 Q. It would depend on the length of the
24 lapse?

25 A. Yes, it would, indeed.

1 Q. And if you go to the next page in the
2 left-hand column, the conclusion is set out:

3 Utilities in industry face dynamic
4 market conditions which will require a
5 variety of technology and response
6 options. All technology options should
7 be kept open and none should be
8 dismissed.

9 You would agree with that conclusion with
10 particular reference to nuclear power, would you not?

11 A. Well, apart from the reference to
12 nuclear power, I think that conclusion is an important
13 one, and it certainly also applies to nuclear power.

14 Q. If we could go to page 10, the
15 left-hand column, at the bottom of the page the
16 conclusion is set out:

17 The results of comparative risk
18 assessments of the different energy
19 systems indicate that under routine
20 operating conditions nuclear power and
21 renewable energy systems tend to be in
22 the lower spectrum of health risk and
23 that energy systems based on coal and oil
24 are in the higher spectrum of health
25 risk.

1 You are aware that that seems to be the
2 current state of knowledge with respect to health risks
3 of various technologies?

4 A. I am certainly aware of it and there
5 is a growing body of literature on that subject. I
6 haven't got personal experience of doing that type of
7 risk assessment.

8 Q. But at your level within the
9 corporation you have to be aware of that kind of thing;
10 correct?

11 A. Yes, I am aware of it. One renewable
12 energy system, of course, is hydroelectric generation,
13 and there are certain circumstances where you could
14 argue that perhaps that's not at the lower end of the
15 spectrum of health risk.

16 Q. If you go to the next conclusion you
17 will see just that. In the right-hand column, it is
18 stated -- well, first of all at the top of that column
19 they conclude:

20 That the potential for severe
21 accidents exists for most energy systems
22 as various stages of their fuel cycles.

23 You are aware of that?

24 A. Yes.

25 Q. But then next to respond to your

1 point, the conclusion is:

2 Rough estimates suggest that the human
3 health risks from severe accidents from
4 nuclear, oil and natural gas are of the
5 same order of magnitude and two orders of
6 magnitude smaller than those from the
7 hydroelectric option.

8 Is that what you were referring to a
9 moment ago, that kind of comparison?

10 A. Well, there certainly is some
11 historical evidence that there have been problems with
12 hydroelectric dams and overflows. Whether we can
13 generalize and say that therefore in the future that
14 will continue to be the case, I really don't know.

15 I would hope that we would learn from our
16 past and avoid these problems with hydroelectric.

17 Q. But, for example, they are very large
18 construction projects and there is a risk of fatality
19 with those; is there not?

20 A. They are large, like nuclear is also
21 large.

22 Q. Well, the nuclear experience of
23 Ontario Hydro in construction has been superb, hasn't
24 it?

25 A. I am sure we could always improve,

1 but it's quite true that we have not had a fatal
2 accident on Darlington, for example,

3 Q. Someone died in a car accident and
4 that produced one fatality.

5 A. Yes, unfortunately he did on the way
6 to the airport, but I was referring to the construction
7 of Darlington when I made my comment.

8 Q. And then towards the bottom of that
9 column:

10 Comparative risk assessment will play
11 an increasingly important role in energy
12 planning by providing decision-makers
13 with critical input into the formulation
14 of appropriate modes and mixes of
15 electricity generation.

16 Mr. Campbell may say that's a planning
17 question, but would you agree with that conclusion?

18 A. Well, we touched on this subject of
19 course before the break, Mr. King talked about it a
20 little. I think the statement here is true and
21 comparative risk assessment will play a part in our
22 future decisions, and that's why we have an Institute
23 for Risk Research here in Canada.

24 Q. Right. And at page 12 the final
25 conclusion that I will refer you to, at the top of the

1 left-hand column we find the statement:

2 A degree of paralysis in
3 decision-making currently prevails at the
4 very time when the consequences of not
5 taking timely decisions have also become
6 more severe.

7 With respect to the selection of an
8 energy option like nuclear, would you not agree that
9 there is a risk in permitting one's decision-making to
10 be paralyzed?

11 A. Well, we are not going to get
12 anywhere if we paralyze our decision-making. I think
13 that this executive summary points out that there are
14 some very serious and many issues that face the future
15 energy scene in the world that have to be taken, such
16 as a forum like this one.

17 Q. If we could look to Volume 1, which
18 was the volume that Mr. Heintzman was using, there are
19 documents in there that I would like to refer to. I
20 believe they are at tab 19, although my copy was
21 pretabbed.

22 [12:20 p.m.]

23 I'm sorry, it's tab 15 I'm told in other
24 peoples' books. Interrogatory 9.15.5.

25 THE REGISTRAR: That is .43.

1 ---EXHIBIT NO. 520.43: Interrogatory No. 9.15.5.

2 MR. HAMER: Q. And one of the
3 intervenors put the question:

4 What are the documented occupational
5 and public health effects and incremental
6 health risks, if any, in the vicinity of
7 nuclear and fossil-fired generating
8 stations and in the vicinity of uranium
9 and coal mines.

10 And a list was attached setting out an
11 answer:

12 There is a range of opinion on the
13 anticipated occupational and public
14 health risks associated with energy
15 production. The following reports are
16 attached.

17 And I wonder if any one of the panel can
18 assist us as to the selection of those two reports and
19 then the listing of a great many other reports.

20 I took it that those two reports were
21 regarded by Ontario Hydro as being two of the more
22 helpful and authoritative discussions. Are you able to
23 assist us on that, Dr. Whillans?

24 DR. WHILLANS: A. No, I'm sorry, I don't
25 know how the list was chosen.

1 Q. All right. You recognize those two
2 reports, the first being the ACNS 10, the Advisory
3 Committee on Nuclear Safety of the Atomic Energy
4 Control Board?

5 A. I recognize that one, yes.

6 Q. And that's referred to in several
7 places in Exhibit 507.

8 A. That's right.

9 Q. The second is an English report
10 dealing with the same area, Comparative Risks of
11 Electricity Production Systems, A Critical Survey of
12 the Literature, and you are familiar with that
13 document?

14 A. Well, I know it only because I see it
15 on the following pages. I notice that it's quite an
16 old reference.

17 Q. Is any other member of the panel able
18 to rank these various reports and shed light on why
19 those two reports were selected?

20 MR. KING: A. I can only say that the
21 ACNS report I think is fairly obviously, that is, it is
22 a Canadian report and it's a fairly recent report.

23 Q. And in looking at the list of
24 additional reports, Paskievici is a Canadian reference
25 as well; is it not?

1 A. Yes.

2 Q. Indeed he was one of Dr. Hare's
3 technical advisors we saw earlier?

4 A. Yes, he was.

5 Q. And Inhaber is a Canadian authority
6 in this area as well?

7 A. Actually I am not sure what his
8 nationality is. He has lived in the States for the
9 last 10 years or so.

10 Q. All right. We see his literature
11 referenced in Exhibit 507 as well though; do we not?

12 A. Yes.

13 Q. If we go to the first of the two
14 reports which were produced, the Cohen & Pritchard
15 study, I guess this has all been marked as an exhibit.

16 I think I might be able to shorten this.
17 If we go to page 7 at the introduction, we can see in
18 Item 2 in discussing the comparisons to be made in the
19 reports:

20 Implicit in these comparisons is the
21 fact that no human activity can be
22 absolutely risk free either in operation
23 or in subsequent management of the
24 inevitable wastes. Even the option of
25 doing nothing can produce risk. For

1 example, a decision not to extend or
2 renew an electricity supply system could
3 lead to considerable economic or social
4 risks.

5 And, Mr. Penn, from your perspective, you
6 would agree with that observation; would you not?

7 MR. PENN: A. I certainly agree with the
8 first sentence that no human activity can be absolutely
9 risk free whether in operation or subsequent management
10 of inevitable waste.

11 You certainly take risk with doing
12 nothing and not providing future growth in electrical
13 generation, in my view, can lead to reduced economic
14 and higher social risk.

15 Q. Sorry, to reduced economic risks?

16 A. No, to reduced economy.

17 Q. And high social risks?

18 A. Yes, and higher social risks.

19 Q. Yes. And then at the bottom of the
20 introduction, Item 5, the authors observe that:

21 It is essential to compare systems
22 as a whole otherwise artificial and
23 misleading answers can arise. For
24 example, stations burning coal which
25 includes traces of radioactive substances

1 put out small amounts of radioactivity
2 comparable in ultimate dose effects to
3 those of some nuclear power stations
4 under normal operational conditions.

5 Dr. Whillans, from your knowledge in the
6 area of radiation, you are aware that the combustion of
7 coal does produce emissions, very small, of radioactive
8 substances?

9 DR. WHILLANS: A. Yes.

10 Q. And that applies to coal electrical
11 power plants?

12 A. I believe so.

13 Q. And then the authors go on to point
14 out that:

15 One has to take into account the
16 radioactive risks of nuclear fuel
17 processing, long-term storage of nuclear
18 waste, and the risk of possible major
19 incidents. All these and others must be
20 included when assessing a nuclear system.
21 Competing systems must be similarly
22 treated.

23 And, Dr. Whillans, to stay on the coal
24 example, it is appropriate even from the radiation
25 point of view to consider the back end of the fuel

1 cycle, if you like?

2 A. Yes. I think if there are
3 significant sources of radioactivity, then they should
4 be considered, yes.

5 Q. Yes. Am I correct in understanding
6 that you have not been asked at Ontario Hydro to
7 consider the effects of radiation emitted from Ontario
8 Hydro's coal stations?

9 A. That's correct.

10 Q. Are you aware of any other officials
11 of Hydro or personnel at Hydro who consider that
12 matter.

13 A. I don't know anyone specifically, no.

14 Q. If we could go to the conclusions in
15 this report at page 24 -- I'm sorry, back to 22.

16 MR. KING: A. I might add on that last
17 point that I'm aware of reports being written which
18 discuss the radioactive emissions from coal stations.

19 I am not familiar with the reports, but
20 I'm aware that they have been written.

21 Q. Would your knowledge go this far:
22 It's my understanding that as with nuclear stations,
23 the radioactive emissions from coal stations are
24 considered to be well within acceptable limits. That's
25 fair; isn't it?

1 A. I said, I'm not familiar with the
2 details of them, but I know that the releases are
3 small. They exist and they are small.

4 Q. They don't attract as much attention
5 as the emissions from nuclear stations though; do they?

6 A. I'm quite sure of that.

7 Q. I'm sorry?

8 A. I'm quite sure of that.

9 Q. At page 22 these authors conclude at
10 paragraph 77, subject to a great many qualifications
11 after discussing the literature in this area that:

12 Subject to all the above
13 qualifications, for the same quantity of
14 electricity produced the estimated
15 probability of events with a similar
16 number of casualties seems to be very
17 roughly the same both for nuclear systems
18 and the element of refinery hazard which
19 must be linked to an oil burning
20 system, though the size of risk of a
21 refinery depends on its nature and
22 whether certain additional installations
23 are present. Et cetera.

24 Are you able to agree or disagree with
25 those observations, Mr. King? It's paragraph 77 on

1 page 22.

2 A. Which sentences were they?

3 Q. The second sentence in the paragraph,
4 subject to all the above qualifications...

5 A. Do I get to read all the above
6 qualifications?

7 Q. I attempted to summarize them. They
8 arise largely out of differences in the literature
9 which is reviewed in the earlier part of the article.

10 A. All I can do is confirm that that is
11 what the sentence says right here. I have no other
12 knowledge.

13 Q. Are you able to assist us on that,
14 Dr. Whillans?

15 MR. B. CAMPBELL: Mr. Chairman I'm, a
16 little concerned that in this particular case - and I
17 have tried to, I understand what it's like to be told
18 to sit down and I have tried to sit down - but here we
19 are talking about a risk of a refinery depending on its
20 nature, whether certain additional installations are
21 present commonly found in refineries but not strictly
22 required there.

23 I don't think anybody on this panel has
24 any knowledge of whatever that is that's talked about.
25 I certainly don't know what it is, and I'm not even

1 aware of whether those installations are described
2 anywhere in the document.

3 THE CHAIRMAN: As a matter of fact, I
4 just looked at it. It seems to me it is a comparison
5 between an oil refinery and a nuclear plant.

6 It then says that coal plants are
7 something smaller and different. And so I don't know
8 whether this is really a comparison that is very
9 appropriate to this particular hearing because, as I
10 recall, there's no oil-fired generation in Ontario even
11 being contemplated at this time.

12 MR. B. CAMPBELL: Well, my point, Mr.
13 Chairman, is simply this, that even if there was a
14 description of what all these additional installations
15 that are oil refineries were all about in the sentence
16 that's been referred to, I don't have anybody on this
17 panel, I know, that has oil refinery experience and
18 could validly an opinion on that.

19 I mean, I think this case we have been
20 pushing it quite a lot, and this is really pushing it
21 too far, in my submission.

22 MR. HAMER: Well, Mr. Chairman, I don't
23 ask the question of these witnesses as experts in oil
24 refining, I ask it as a question going to comparative
25 risks of different fuel cycles, and the oil fuel cycle

1 involves oil refineries.

2 I appreciate there's no question of
3 oil-fired stations in this hearing, but it assists in
4 putting the risks of a nuclear stations into a
5 perspective, in my submission.

6 MR. B. CAMPBELL: Well, Mr. Chairman, my
7 witness is being asked to agree with the statement --
8 can he confirm that statement, and all I'm saying is
9 that there is not anywhere near enough information
10 either about what's referred to in this statement, even
11 on the face of it, to be able to express that opinion.

12 The sentence says: Certain types of
13 refineries with certain installations and certain
14 locations. I mean, before any reasonable opinion could
15 be expressed, you would have to know all of that, and
16 we don't, and even without knowing all of that, none of
17 these people are in a position, I think, to compare
18 nuclear to oil refineries with which they have no
19 experience whatsoever.

20 And with great respect to my friend,
21 that's what he has asked him to do.

22 MR. HAMER: Well, I'm puzzled, Mr.
23 Chairman. As I understand what --

24 THE CHAIRMAN: Why don't we continue with
25 the examination and then we'll see if the questions are

1 appropriate or not.

2 I think I have lost track of what the
3 question was that Mr. Campbell rose on. I must say, I
4 had the same general concern when I was reading the
5 passage.

6 MR. HAMER: Q. Let me step back this
7 far, Dr. Whillans. In developing risk assessments,
8 both for assessing one option and then comparing it to
9 others, it's my understanding that what one does, as
10 Hydro did in Exhibit 507, is to conduct a literature
11 review to see what the world literature says about the
12 risks of various energy options, and isn't that was
13 done in developing the figures in Exhibit 507, a
14 literature review?

15 DR. WHILLANS: A. That's correct.

16 Q. The person reviewing the literature
17 is not necessarily an expert in all of those
18 technologies; correct?

19 A. That's correct.

20 Q. And you simply --

21 THE CHAIRMAN: Just to make sure, 507
22 deals with the effects of nuclear generation only.

23 MR. HAMER: Yes.

24 THE CHAIRMAN: Is that correct?

25 MR. HAMER: That's correct.

1 THE CHAIRMAN: Does it contain - I don't
2 know it off by heart - has it got a comparison with
3 other technologies in it?

4 MR. HAMER: It does cite figures for the
5 coal and hydraulic generation options, Mr. Chairman.

6 THE CHAIRMAN: All right.

7 MR. HAMER: At page 5-24. I will be
8 coming to that.

9 THE CHAIRMAN: Right.

10 MR. HAMER: Q. And my only point, and
11 probably I'm sure we spent too much time on it, but my
12 only point is that this literature that we have before
13 us from the United Kingdom indicates that nuclear, when
14 the whole fuel cycle is considered, compares favourably
15 with oil generated electricity; correct?

16 DR. WHILLANS: A. Well, I agreed with
17 you when you described how we produced table 5.1, that
18 it was a review and that the person did not necessarily
19 have to be expert in all areas.

20 And, as the Chairman pointed out, that
21 table considered nuclear fuel cycle, but it included
22 areas like mining, where we are not expert, but we are
23 familiar with it.

24 I think when you go to other forms of
25 electricity generation, I'm certainly not familiar and,

1 certainly when you go outside electricity generation to
2 aspects of the hazard that have only indirect relation
3 such as the oil refinery, I certainly can't help you,
4 I'm sorry.

5 Q. And is your answer any different, Mr.
6 King?

7 MR. KING: A. No, it's not.

8 Q. Dr. Whillans, there are frequent
9 references in Exhibit 507 to the next document produced
10 by Hydro in response to this interrogatory, and that is
11 the Advisory Committee on Nuclear Safety report
12 entitled Alternative Electrical Energy Systems, A
13 Comparison of The Risks of Occupational and Public
14 Fatalities.

15 DR. WHILLANS: A. That's true, it is
16 referenced.

17 Q. I believe, Mr. King, in answer to a
18 question yesterday about the contents of the Hare
19 Report confirmed that that was one of the documents
20 that Dr. Hare praised as being a superb study. Do you
21 recall that?

22 MR. KING: A. I recall words to that
23 effect in the Hare Commission Report.

24 Q. And just to look at the abstract, the
25 authors of this --

1 DR. WHILLANS: A. Sorry, where are you
2 looking?

3 Q. The abstract of the ACNS10.

4 A. And that follows the -- okay, I have
5 it.

6 Q. That indicates that the authors of
7 that report concluded that the occupational risks of
8 the coal fuel cycle are about 2 to 4 times higher than
9 those from the nuclear hydraulic systems, and that the
10 public risks from the coal-fired system are also
11 somewhat greater than those from the nuclear or
12 hydraulic systems.

13 A. That's what they conclude, yes.

14 Q. All right. And that's one of the
15 prime documents from which the statistics or figures
16 relating to nuclear generation were drawn for purposes
17 of Exhibit 507; correct?

18 A. That's true.

19 Q. And, Dr. Whillans, you have no reason
20 to consider the figures in this report relating to coal
21 and hydraulic generation as being any less reliable
22 than the figures relating to nuclear generation?

23 A. Well, I have been asked this question
24 before and the simple answer is no, but--

25 Q. I can take you someplace --

1 A. --I can't confirm the converse
2 either. I have no reason to believe or disbelieve
3 them, other than that the authors are the same and
4 their methodology is probably sound.

5 But as I pointed out, I don't know
6 whether the basic data from which they derived the
7 risks is as sound as it is for nuclear.

8 Q. All right. But when your literature
9 reviewer went to a reliable document, this is one of
10 the ones that she went to; correct?

11 A. Yes, that's certainly true, and for
12 the reasons that Mr. King, mentioned, it's a recent
13 review, it's Canadian, and we are familiar with some of
14 the authors, yes.

15 Q. And at page Roman numeral 12 we find
16 a further conclusion in the second paragraph:

17 The risks of public and occupational
18 fatalities from catastrophic accidents
19 are very low for all the technologies
20 assessed in this report and, furthermore,
21 are probably lower in Canada than in the
22 world at large.

23 Would you agree that that is a fair
24 conclusion, Mr. King, with respect to nuclear, first of
25 all?

1 [12:40 p.m.]

2 A. I can speak to CANDU, I cannot speak
3 to the risks from all other reactor types around the
4 world.

5 Q. With respect to CANDU, though, you
6 would agree with that conclusion?

7 A. I believe the sentence is comparing
8 what is in Canada to the world at large, so you need to
9 know both sides of the equation before you can agree
10 with that conclusion.

11 Q. Is there anyone else on the panel
12 that can answer with respect to the comparison between
13 CANDU and other forms of reactors?

14 (No response)

15 From your knowledge, Mr. King, of the
16 literature, would you agree that the risks of public
17 and occupational fatalities from catastrophic accidents
18 are very low for all the technologies assessed in the
19 report which I understand to be coal, hydraulic,
20 nuclear, oil and gas?

21 A. I go back to what I have said many
22 times. I can speak to nuclear, I can't speak to
23 comparing the risks from all the other technologies.

24 Q. I would like to look next at Exhibit
25 519, page 52, and I believe we passed out a loose copy

1 of that that could be inserted in our Volume 2 at tab
2 9, if one wants to keep those things together.

3 THE CHAIRMAN: I'm sorry, the page again,
4 please?

5 MR. HAMER: Page 52 of Exhibit 519.

6 Q. Mr. Penn, I believe you spoke to this
7 table in chief - I may be wrong - but that table sets
8 out the quantity of used fuel that has resulted from
9 Ontario Hydro's operations to the end of 1990 and then
10 forecasts a total based on assumed 40-year station
11 lives; correct?

12 MR. PENN: A. Well, Mr. Johansen
13 actually spoke to the subject.

14 Q. All right. But, Mr. Penn, you, I
15 believe, spoke to the question of comparisons between
16 generating electricity by way of coal as opposed to
17 nuclear and the economic differences that one sees in
18 those two operations?

19 A. I briefly mentioned in the
20 introductory passage that if you were to compare the
21 levelized unit energy costs for in-service of a
22 conventional steam cycle 4 by 800 megawatt coal-fired
23 plant using U.S. coal, with a 4 by 881 megawatt also
24 in-service in 2002, then the nuclear would have a 10 to
25 15 per cent levelized unit energy cost advantage.

1 That's the only comparison I recall making with coal.

2 Q. In the past Ontario Hydro actually
3 used to publish documents which showed the differences
4 in the cost between the coal generation and the nuclear
5 generation; is that not correct?

6 A. Well, we certainly have produced
7 figures on total unit energy costs, for example,
8 between our existing nuclear and coal-fired plants,
9 specifically Pickering and Lambton, because in a
10 contractual agreement between the province, Atomic
11 Energy of Canada and Hydro exists on the differences
12 between those two costs.

13 Q. Turning to this table on page 52 we
14 see the quantity of used fuel that has been produced to
15 the end of 1990, and it would be possible, would it
16 not, to calculate the energy which has been generated
17 from that fuel?

18 A. Yes, it would be.

19 Q. And similarly one could do that for
20 the forecast totals of used fuel in the right-hand
21 column?

22 A. Yes, you could.

23 Q. And what I would like to ask is if
24 the fuel to the end of 1990, if the energy attributable
25 to that fuel had been produced by coal instead, how

1. much coal would it have taken to produce the same
2 electricity, the same energy? It is possible to make
3 that calculation as well; is it not?

4 A. Yes, it is possible, but you would
5 have to make a number of assumptions, of course. You
6 would have to decide where is the coal coming from,
7 because unlike uranium, coal has different BTUs per
8 pound depending on what its nature is. So you would
9 have to make those types of assumptions.

10 Q. Just in rough terms one could take an
11 average, though, could one not?

12 A. You could assume coal from Ohio, for
13 example, and do that calculation.

14 Q. And what I would like to find out,
15 and I will ask for an undertaking on this, but let me
16 tell you first what I would to find out is the amount
17 of coal on an averaged basis, averaging the BTU
18 characteristics, it would have taken to produce the
19 equivalent energy attributable to that used fuel in
20 this table on page 52, and then how much carbon dioxide
21 would have been produced by that coal.

22 THE CHAIRMAN: Just hold it a second. I
23 want to make sure I am following what you are saying.
24 First of all you have to find out how much energy is
25 represented by the 75,000 waste here. Is that known?

1 Is that something you know?

2 MR. HAMER: The witness has said that one
3 could calculate the energy attributable to that, Mr.
4 Chairman.

5 THE CHAIRMAN: Oh, they can do that.

6 MR. PENN: It can be done, sir.

7 MR. HAMER: Q. That's probably the
8 easiest part of it. It gets a little more complicated
9 after that, doesn't it? Right?

10 MR. PENN: A. I don't think it's
11 particularly complicated, but I am kind of surprised
12 with all these interrogatories we have answered that we
13 haven't possibly answered that question already.

14 Q. Well, if you have, I would be content
15 simply to be directed to the answer.

16 A. May be we might start by checking
17 that before we do new calculations.

18 MR. HAMER: Well, let me complete the
19 request.

20 THE CHAIRMAN: What you want to know is
21 how much CO(2) would have been produced by coal-fired
22 generation as against nuclear?

23 MR. HAMER: Exactly. And I was going
24 through the steps that it takes to get to that.

25 I need him to confirm that it is possible

1 to make the calculation. I understand he is able to go
2 through the steps to get the carbon dioxide equivalent
3 for the same amount of energy.

4 MR. PENN: Well, if it's of any
5 assistance to you, I can tell as a rule of thumb that
6 if we hadn't had any nuclear system in Ontario at all;
7 in other words, we wouldn't have burnt these 14,400, or
8 consumed the 14,400 nuclear fuel bundles, but instead,
9 hypothetically, we had burned coal, then the CO(2)
10 releases in general terms would have been about twice
11 what they have been.

12 I don't know if that's sufficient for
13 your purposes.

14 MR. HAMER: Q. That's so far so good.

15 Can you answer the same question on an
16 average basis with respect to sulphur dioxide?

17 MR. PENN: A. On an average basis the
18 answer would be very similar.

19 Q. Twice?

20 A. Twice as much.

21 Q. It's the same ratio, I guess. And
22 the same obviously applies for the forecast column on
23 the right?

24 A. Well, I was trying to be helpful by
25 giving you some rough guides. If we want to go further

1 than that then we will have to check the numbers.

2 Q. All I was trying to get at is could
3 one take the forecast column and say that if instead of
4 consuming the fuel bundles forecast to be consumed one
5 were to burn coal, one would double the sulphur dioxide
6 and carbon dioxide emissions that one otherwise would
7 have?

8 A. I was just telling you that as a rule
9 of thumb. But I am sure that Panel 8 discussed things
10 like integrated gasification combined-cycle where you
11 would have learned that given the efficiency
12 improvements that the CO(2) release from that
13 particular fossil option is less than the conventional
14 steam cycle.

15 So we have to make other assumptions in
16 looking at -- I am just pointing out we have to make
17 another assumption in of assumption in looking at
18 forecasts in the future, and we have to make another
19 assumption on, well, would we ever do anything about
20 trying to absorb the carbon dioxide or part of it in
21 the future.

22 So I think to answer your question, we
23 better lay out all the assumptions that we are going to
24 make so that we are quite clear what it all means.

25 MR. B. CAMPBELL: Then I am not sure I

1 want, to (A) either go through the exercise or, (B)
2 volunteer to do the calculation.

3 We have emission rates in the material
4 for a variety of technologies. It's my expectation,
5 and if my recollection -- it's certainly my expectation
6 that AECL has the full capability of doing the
7 comparison between their own type of generation and
8 coal and doing their only calculation. If they would
9 like to produce a calculation with the complete set
10 assumptions, we will undertake to say whether we
11 disagree or agree with the assumptions in the
12 calculation.

13 But in my submission, giving AECL's
14 capability and its obvious interest as it has for many
15 years in comparing nuclear and fossil, this is not a
16 case where it's appropriate necessarily to impose this
17 burden on Ontario Hydro.

18 MR. HAMER: Well, I am content to put
19 some calculations to Ontario Hydro and Mr. Campbell and
20 I can discuss them off the record.

21 Q. Before I leave the topic, Mr. Penn,
22 going back to the left-hand column, the fuel that has
23 been consumed, do you have a rough rule of thumb like
24 the previous ones you have given us with respect to
25 NOx, or nitrous oxide?

1 MR. PENN: A. Subject to check over
2 lunch, my rule of thumb also applies to nitrous oxide.

3 Q. I am told that you gave some
4 submissions yourself to the Select Committee setting
5 out data making these kind of comparisons; do you
6 recall that?

7 A. I believe I went through that with
8 Mr. Heintzman.

9 Q. If the energy equivalent coal had
10 been burned in place of these nuclear fuel bundles, how
11 much solid waste would remain behind, roughly speaking?

12 A. I am afraid I can't answer that right
13 now off the top of my head.

14 You are referring to the amount of ash
15 that would be produced?

16 Q. Or any or solid waste. I take it
17 it's all ash.

18 A. Particulate matter?

19 Q. Yes.

20 THE CHAIRMAN: Again, there is evidence,
21 I think, in Panel 8 that could be used to do those
22 calculations.

23 MR. B. CAMPBELL: If my friend was
24 familiar with the environmental analysis, he would know
25 that at table A-1 there are a whole set of typical

1 factors used for calculation of parameter values.

2 There is a whole set for resource use, water,
3 emissions, effluents, various parameters including
4 coal, radionuclides, thermal discharges, coal mining
5 effluent, et cetera, et cetera. I invite him to make
6 whatever calculation he wants based on those factors.

7 MR. HEINTZMAN: What is the page number?

8 MR. B. CAMPBELL: It's A-2, A-3, is one
9 that I can turn up immediately. I know that there are
10 other trace elements emissions, for instance, on A-4,
11 and there is a discussion of these kinds of
12 calculations and various examples contained within
13 there.

14 MR. BULLOCK: Mr. Chairman, at the risk
15 of complicating the issue even more, certainly one of
16 the questions that I had intended to impose during
17 CNA's cross-examination was dealing with an
18 interrogatory that had been put to Hydro sometime ago,
19 last October, dealing with very much these kinds of
20 issues. And I know that material hasn't been put into
21 the record yet, but perhaps I suspect over lunch time
22 my friend Mr. Campbell and the panel might want to have
23 a look at CNA interrogatory question 11.44.2, which
24 deals very much, sir, with these kinds of question, and
25 suffice it to say that the answer was incomplete.

1 THE CHAIRMAN: I wonder if anyone would
2 mind if we adjourned just a little early and perhaps
3 the discussions can continue informally and we can get
4 back on the rails at 2:30.

5 MR. HAMER: Thank you, Mr. Chairman.

6 THE REGISTRAR: Please come to order.
7 This hearing will adjourn until 2:30.

8 ---Luncheon recess at 12:55 p.m.

9 ---On resuming at 2:35 p.m.

10 THE REGISTRAR: Please come to order.
11 This hearing is again in session. Please be seated.

12 THE CHAIRMAN: Mr. Poch.

13 MR. D. POCH: Just to advise the Board,
14 I've left with Mr. Lucas eight copies of an exhibit
15 which we would like to file today entitled:
16 Performance Reliability of Ontario Hydro CANDU Plants
17 by Mr. Charles Komanoff.

18 And I wanted the Board to have that, it's
19 also a matter that is of interest to the Energy Board
20 and I know it's going to become a public document
21 fairly soon, but I wanted you to have it at the same
22 time.

23 THE CHAIRMAN: Well, I guess it's a
24 public document now.

25 MR. D. POCH: Yes. And indeed it was

1 prepared for this hearing, Mr. Chairman.

2 THE CHAIRMAN: Right. Number...?

3 THE REGISTRAR: 563, Mr. Chairman.

4 ---EXHIBIT NO. 563: Document entitled: Performance
5 Reliability of Ontario Hydro CANDU Plants
by Mr. Charles Komanoff.

6 MR. D. POCH: Thank you very much.

7 THE CHAIRMAN: Thank you, Mr. Poch.

8 Mr. Hamer.

9 MR. HAMER: I think we perhaps found a
10 way to figure this out, Mr. Chairman.

11 Q. Mr. Penn, do I understand correctly
12 that we can take comparisons for coal use of fuel and
13 emissions and solid waste from Exhibit 4 - and we don't
14 need to turn this up because I am going to get an
15 undertaking, Mr. Chairman - Exhibit 4, table 5-2 on
16 page 5-7?

17 MR. PENN: A. Yes. That table gives for
18 each of the cases 23, 22, 15, 24, 26, for median load,
19 all quantities of SO(2), NOx, CO(2) and particulate
20 matter which I think you talked about before lunch in
21 tonnes or in gigagrams, whatever the case might be.

22 Q. As well, in Exhibit 3 on page 14-29
23 we have different generating option examples and,
24 again, the SOx, NOx and CO(2) and solid wastes are
25 compared there in comparable units; correct?

1 A. Yes. On figure 14-20 of Exhibit 3
2 and for each of the fossil options that are 10 in
3 number, we give SO(2), NOx and CO(2) and solid waste in
4 grams per kilowatthour.

5 Q. And one can take the total energy
6 requirements for the lifespan of the various cases that
7 have been proposed by Hydro, 23, 22, 15 and so forth,
8 and work out between these two tables the totals of
9 solid waste, SOx, NOx and CO(2) as well as the original
10 fuel requirements for each of those cases?

11 A. Well, from the terawatthours for each
12 of those cases, and using this data in 14-20, you can
13 calculate the mass of each of those emissions.

14 Q. I believe you are prepared to
15 undertake that if we do all that and show it to you,
16 you will confirm its accuracy, or correct it?

17 MR. B. CAMPBELL: We are prepared to do
18 that. I would just ask that there have been several
19 corrections to -- there was some sort of glitch when
20 this stuff got put in the book at some point, and I
21 know there have been corrections to some of these
22 numbers filed.

23 I can speak to my friend later, once I
24 get sorted out exactly where they, or I'll advise him
25 as to which staff at Ontario Hydro to get in touch with

1 to make sure he's working from the correct numbers.

2 But I know, for instance, that in
3 Interrogatory 2.9.2 there were corrections to the
4 emission factors that were used.

5 So with that caution, and if my friend
6 would speak to me about where to get all the right
7 numbers to use, then making sure that he's got the
8 correct ones, the corrected figures, then we can save
9 at least that loop of having to go back for that
10 reason.

11 MR. HAMER: I'm starting to think maybe
12 Ontario Hydro should do this after all.

13 THE CHAIRMAN: Did you say table 5-2; is
14 that right, or figure 5-2?

15 MR. PENN: Table 5-2 is the one, Mr.
16 Chairman, that gives cumulative effects from 1989 to
17 2014 for the median load growth--

18 THE CHAIRMAN: Right.

19 MR. PENN: --of each of the cases in the
20 DSP that was submitted in December, '89.

21 THE CHAIRMAN: Right. Now --

22 MR. PENN: It gives all the masses for
23 these various emissions.

24 THE CHAIRMAN: Right. Then you referred
25 to 5-7, I wasn't sure --

1 MR. HAMER: The table is on page 5-7.

2 THE CHAIRMAN: Oh, I'm sorry. All right,
3 that's where I got it. All right.

4 MR. HAMER: Q. Could we turn then,
5 please, to Volume 2 of our book, tab 13, which deals
6 with radiological impact of airborne effluents of coal
7 and of nuclear plants.

8 Mr. Johansen, I believe I had given you
9 some advance notice that I would be asking you about
10 this particular article.

11 THE CHAIRMAN: Should this be given a
12 number?

13 MR. HAMER: Yes, please, Mr. Chairman.
14 tab 13 of Volume 2.

15 THE REGISTRAR: 564, Mr. Chairman.

16 ---EXHIBIT NO. 564: Article entitled: Radiological
17 Impact of Airborne Effluents of Coal and
18 Nuclear Plants authored by McBride, et
al, published in December 8, 1978
edition of Science.

19 THE CHAIRMAN: It's 14 years old I
20 notice, the article.

21 MR. HAMER: That's correct.

22 THE CHAIRMAN: I don't know if that's of
23 any significance.

24 MR. HAMER: Well, we'll find that out.

25 Q. This appeared in Science which is a

1 well respected scientific journal, Mr. Johansen?

2 MR. JOHANSEN: A. Yes, it is.

3 Q. And have you had an opportunity to
4 review that?

5 A. Briefly. I recall seeing it, oh,
6 must be 10 years ago or more.

7 Q. Essentially what the authors set out
8 to do was to compare the emissions of radioactivity
9 from then modern coal plants with those from nuclear
10 stations; correct?

11 A. That's right.

12 Q. And you don't have any difficulty
13 with the proposition that coal plants emit radiation in
14 small quantities?

15 A. No, that's correct.

16 Q. These authors conclude at page 1049,
17 which is the second last page in the article:

18 "The radiological impact of naturally
19 occurring radionuclides emitted in the
20 airborne effluent of a model advanced
21 1000-MWe coal-fired steam plant,
22 burning coal with a uranium content of
23 1 ppm and a thorium content of 2 ppm and
24 releasing 1 per cent of the total ash in
25 the coal to the atmosphere, was evaluated

1 and compared with the impact of the
2 materials in...1000-MWe light water
3 reactors."

4 And then almost at the bottom of that
5 right-hand column, about 20 lines up, the results
6 appear:

7 "The estimated 50-year dose
8 commitments to the whole body per year of
9 plant operation in millirems, were: coal
10 plant 1.9; BWR, 4.6; and PWR, 1.8."

11 And would you recognize figures like that
12 as being roughly accurate?

13 A. Well, I really can't comment on the
14 BWR and PWR numbers. These would have been based on
15 American designs and operating conditions.

16 Q. Hydro's plants emit less than boiling
17 water reactors, we know that; don't we?

18 A. Yes. And really the number 1.9 would
19 have been subject to a lot of assumptions about coal
20 quality, pollution control equipment, operating
21 conditions and the like which may or may not be
22 consistent with the comparable parameters that we would
23 use.

24 But I can observe from my past review of
25 the literature and involvement in past fossil projects

1 that that sort of number is in the ballpark.

2 Q. All right.

3 THE CHAIRMAN: I'm sorry, I didn't hear
4 the end of that. That sort of number is what?

5 MR. JOHANSEN: Is in the ballpark.

6 THE CHAIRMAN: Right.

7 MR. HAMER: Q. And these numbers are
8 based only on airborne effluents according to the
9 authors; correct?

10 MR. JOHANSEN: A. That's not clear to
11 me. It was a long time that I looked at this in
12 detail.

13 Q. If you look at the top of that column
14 under the heading conclusion--

15 A. Yes.

16 Q. --they say:

17 "The radiological impact of
18 naturally occurring radionuclides
19 emitted in the airborne effluent..."

20 A. Okay, yes, I see that.

21 Q. And, again, the nuclear effluents
22 were also the airborne effluents; correct, we can see
23 that in that paragraph?

24 A. Yes, that's what it says.

25 Q. And what I'm trying to get at is that

1 these figures wouldn't reflect radionuclides remaining
2 in the solid waste from the coal.

3 A. That's right.

4 Q. And the authors say, I think at the
5 first page of the article, 1045, in the right-hand
6 column - I won't read the whole paragraph - but in the
7 full paragraph in that column, to paraphrase, they say
8 that the study doesn't cover the whole fuel cycle of
9 either nuclear or coal and they indicate that:

10 Radioactivity in the coal wastes
11 would have to be assessed to do a whole
12 fuel cycle just as one assesses
13 radioactivity coming from nuclear waste.

14 A. Yes.

15 Q. And then they say, of course, that it
16 leaves aside health effects associated with
17 non-radioactive emissions from the coal-fired plants
18 such as the things we have been discussing,
19 particulates, NOx and SOx; correct?

20 A. Yes, that's what it says.

21 Q. That was before the days of the very
22 large concern concerning carbon dioxide emissions; they
23 don't mention it there?

24 A. 1978, yes, that's generally a fair
25 statement.

1 Q. I'm sorry?

2 A. That's a fair statement.

3 Q. And once again, although there are
4 very small radioactive emissions from both types of
5 stations, it's the emissions from the nuclear stations
6 on which most public attention has been focused?

7 A. Yes, I would agree with that.

8 Q. May we look at Exhibit 507 and I
9 think my excerpts in Volume 2, tab 8 of our book will
10 suffice.

11 At page 5-24, at the end of page 5-24 we
12 have the statement as follows:

13 As stated above, the overall risk
14 reported in this report..., and that's
15 for the whole nuclear fuel cycle,
16 ...is 0.22 fatalities per gigawatt year.

17 And, Dr. Whillans, you and I discussed
18 that figure earlier and we went through the table that
19 produced it; correct?

20 DR. WHILLANS: A. Correct.

21 Q. And then your authors refer to ACNS
22 10 which we have looked at, the Advisory Committee to
23 the AECB, that reports risk values of 6.1 to 8.6
24 fatalities per gigawatt year for the coal cycle and
25 0.33 to 1.1 fatalities per gigawatt year for the

1 hydraulic cycle; correct?

2 A. That's correct.

3 Q. And you have no reason to question
4 those figures and indeed it was appropriate to include
5 them in this report, Exhibit 507?

6 A. I have no reason to question them,
7 that's right.

8 Q. All right. And another author is
9 referred to in the next sentence, very similar results
10 are reported by Fritzsche in 1989 for these fuel
11 cycles; correct?

12 A. Yes, that's what it says, yes.

13 Q. I'm going to have passed to you and
14 to the Board a copy of a similar table to the one you
15 and I went through, which is taken from the fossil
16 Exhibit 468, and this is figure 6.1 in Exhibit 468, and
17 then I have attached to it table 5-1 which you and I
18 Dr. Whillans went through before lunch.

19 Do you see that?

20 A. Yes.

21 THE CHAIRMAN: Just remind me again what
22 Exhibit 468 was.

23 MR. HAMER: I believe it was the fossil
24 equivalent of Exhibit 507, Mr. Chairman.

25 THE CHAIRMAN: Right, thank you.

1 MR. HAMER: Q. And, Dr. Whillans, in the
2 table for fossil generation we can see that Ontario
3 Hydro's evidence has not fastened on a single number
4 for the various aspects of the fossil fuel cycles.
5 That's correct; isn't it?

6 DR. WHILLANS: A. Yes, it seems to be.

7 Q. And indeed what the authors have done
8 is to set out ranges of risks in the various boxes and
9 then cited various authors, similar to the authors who
10 were cited in Exhibit 507; correct?

11 A. Generally, yes.

12 Q. And we can see that different authors
13 produce different ranges of fatality risk in each box?

14 A. Yes.

15 Q. And we see that there is a box for
16 natural gas under extraction and that would be the same
17 box as for mining and milling in table 5-1 from Exhibit
18 507; correct?

19 A. Generally, yes.

20 Q. And then there's transportation for
21 natural gas and operation for natural gas; correct?

22 A. Yes.

23 Q. What we have done on the third page
24 of this little handout - and I would like to take you
25 through this - is to take the natural gas entries on

1 figure 6.1 from the fossil exhibit and put them
2 together, and we can see, for example, that the
3 extraction figures, the various ranges are set out
4 there: 0 to 0.3, 0.03 to 0.2 and so forth. Do you see
5 that?

6 A. Yes.

7 Q. And those come right off figure 6.1;
8 correct?

9 A. You are telling me that. Yes.

10 Q. Well, I would like you to --

11 A. Well, should I check them all.

12 Q. It won't take but a moment.

13 A. Right.

14 THE CHAIRMAN: While we are taking that
15 moment, shall we make this document an exhibit?

16 MR. HAMER: If we could, Mr. Chairman.

17 THE REGISTRAR: No. 565.

18 ---EXHIBIT NO. 565: Figure 6.1 - Summary of Health
19 Impacts - Fossil Generation, Extract
from Exhibit 468.

20 THE CHAIRMAN: Well, perhaps rather than
21 have him check, as we have done in the past, it will be
22 accepted subject to check. Would that be satisfactory?

23 MR. HAMER: Perfectly.

24 DR. WHILLANS: Sorry, I didn't hear.

25 THE CHAIRMAN: The figures, the

1 construction of the table is accepted subject to check,
2 that is, when you get back in the quiet of your office
3 you can look at it and if it's wrong you can come back
4 and tell us.

5 DR. WHILLANS: I think I have checked it
6 to my satisfaction now. It seems to be fine.

7 MR. HAMER: Q. And then what we have
8 done is to take in each box, for example we'll stay on
9 the extraction box, the lowest figure that anybody
10 gives in the literature is 0; correct?

11 DR. WHILLANS: A. Correct.

12 Q. And the highest is 0.7, so that gives
13 us an extreme range from 0 to 0.7?

14 A. For these references, yes.

15 Q. Yes. And then under transportation
16 there's only one range given and that's .009 to .02 and
17 so forth?

18 A. Yes.

19 Q. We have come to the total, and
20 perhaps you could take the totals subject to check,
21 that the complete occupational risk range for the
22 natural gas cycle is 0.018 to 0.738.

23 A. I think that's correct, yes.

24 Q. And the public risk is 0.201 to
25 0.567.

1 A. I hadn't completed checking that one,
2 but...

3 Q. All right. But you'll let us know if
4 there is anything wrong in our arithmetic.

5 And if we sum those, just as we did in
6 the nuclear table, we see that for occupational and
7 public risk combined we get a range of 0.22 to 1.3
8 fatalities per gigawatt year; correct?

9 A. Sorry, could you explain again how
10 you --

11 Q. Yes. For the lower range of the end
12 you take occupational at 0.018.

13 A. Yes.

14 Q. Add that to the lower end of the
15 public range.

16 A. Oh yes. Okay, yes.

17 Q. That gives you .22.

18 A. Yes, okay.

19 Q. Correct?

20 A. Yes.

21 Q. And the same applies for the high end
22 of the range that gives you a total of 1.3 rounded;
23 correct?

24 A. Correct.

25 Q. And that range is a range that one

1 could usefully plug into page 5-24 of your Exhibit 507,
2 given that there is no figure in that paragraph for the
3 natural gas cycle?

4 [2:50 p.m.]

5 A. That sounds reasonable.

6 Q. And given nuclear at 0.22 fatality
7 risk, that places nuclear at the low end of the range
8 that we have just calculated for the natural gas cycle;
9 correct?

10 A. That seems to be true, yes.

11 Q. I think in fairness, the distribution
12 of the various risks attendant on the two fuel cycles
13 is different; isn't it?

14 A. That's right, there is more risk to
15 the public in the gas case.

16 Q. To the public?

17 A. To the public.

18 Q. In fairness, there is probably less
19 risk in the generation phase of the gas fuel cycle than
20 there is for nuclear, but there is more in extraction?

21 A. That's certainly what these numbers
22 seem to say.

23 Q. All right. And just while we have
24 page 5-24 before us, I would like to go two paragraphs
25 up from where we have just been. I am not sure you

1 spoke to this in chief. If one takes the figures for a
2 fatality risk for nuclear generation that you have set
3 out in Exhibit 507, and assuming those numbers, the
4 total numbers of potential fatalities due to
5 conventional accidents would be about 0.2. Do you see
6 that figure?

7 A. I do.

8 Q. And you could compare that with a
9 total number of motor vehicle accidents in Ontario in
10 1989 of 1,286; correct?

11 A. Yes.

12 Q. And of those 161 fatalities were to
13 pedestrians, and the point of that is that people tend
14 to see involuntary risks differently than risks which
15 they voluntarily undertake; correct?

16 A. I think that's an important
17 distinction, yes.

18 Q. And that's one of the observations
19 that's been made about assessing the risk of nuclear
20 stations, is that the lay public tends to regard them
21 as being risks which they don't voluntarily undertake.

22 A. Correct.

23 Q. And then turning to the radiological
24 risks, your report implies about one delayed fatal
25 cancer for all of the electricity generated by nuclear

1 in Ontario in 1989; correct?

2 A. That's what it says, yes.

3 Q. You have no reason to disagree?

4 I take it it was your staff or Mr.

5 Johansen's staff who prepared this.

6 A. Well, it certainly wasn't mine.

7 Q. Would you accept that as being an

8 accurate figure put forward by Ontario Hydro?

9 A. I think it is a different number.

10 THE CHAIRMAN: Where is that statement?

11 MR. HAMER: The second last complete

12 paragraph on the page: In addition, the total

13 radiological risk implied by this --

14 THE CHAIRMAN: Thank you.

15 DR. WHILLANS: I was comparing with what

16 I gave in the direct evidence, but of course that

17 applied only to the generation aspect of the site, so I

18 will accept this, yes.

19 MR. HAMER: Q. And that delayed cancer,

20 there is no statement in the report and there can't be

21 as to when during life that cancer would arise.

22 DR. WHILLANS: A. That's true.

23 Q. And then the comparison is drawn with

24 the 18,000 total cancers which occurred in 1987 in

25 Ontario, according to one source; correct?

1 A. That's right.

2 Q. And about 5,000 of those cancers were
3 attributable to smoking?

4 A. That's what it says, yes. It seems
5 reasonable.

6 ---Off the record.

7 MR. HAMER: Q. I would like to go back
8 to page 4-25 and just confirm one or two other points.
9 This is in the excerpt from 507. I think this is for
10 you, Mr. Johansen.

11 MR. JOHANSEN: A. Did you say 4-25?

12 Q. 4-25, yes. I simply want to confirm
13 with you that that one paragraph on that page
14 represents the complete discussion with respect to the
15 environmental, that is to say non-human effects of
16 non-CANDU reactor types?

17 A. That's my understanding, yes.

18 Q. If we go over to page 5-27, in the
19 final paragraph your authors state that it is not
20 expected that the operation of current generation light
21 water reactors would significantly change the overall
22 fuel cycle risk, but the authors acknowledge that light
23 water reactors have received only a cursory review.

24 A. That's certainly true.

25 Q. The final document for you is

1 somewhere before me. Sorry, Mr. Chairman, I have just
2 misplaced my marked copy.

3 This is an Ontario Hydro publication
4 dated October 1988 - I have had copies passed up to the
5 Board - entitled Nuclear Power in Ontario Perspectives.
6 I wonder if we could have that marked.

7 THE REGISTRAR: 566.

8 ---EXHIBIT NO. 566: Nuclear Power in Ontario
9 Perspectives.

10 MR. HAMER: Q. Mr. Penn would I be
11 correct in thinking that over the past 10 years or so
12 Hydro has taken quite a number of steps to inform the
13 general public more about its general operations than
14 it might have done formerly?

15 MR. PENN: A. Yes, we have through our
16 information centres and through invited talks, and many
17 other ways, yes.

18 Q. One area in particular in which
19 Ontario Hydro has wanted to inform members of the
20 public about was the nuclear operations of Ontario
21 Hydro; correct?

22 A. Yes. But we have also produced books
23 like this for all methods of generation.

24 Q. We see on page 2 of this booklet
25 towards the bottom of the page a discussion of the

1 early history of the CANDU technology, and the
2 statement appears in the final paragraph:

3 The experiments at Chalk River laid
4 the groundwork for the design and
5 development of the one of the best, if
6 not the best nuclear reactors in the
7 world, CANDU.

8 Correct?

9 A. Yes.

10 Q. And on page 5, we see the statement
11 at the end of that page:

12 World-wide nuclear energy is playing
13 an increasingly vital role in meeting the
14 demand for electricity.

15 A. It's certainly playing an increasing
16 role, yes.

17 Q. Then on page 7 we have the statement
18 at the top of the page:

19 The CANDU is one of the greatest
20 technological triumphs in Canadian
21 industrial history and it has paid off
22 handsomely for Ontario Hydro in lower
23 electricity costs and greatly reduced
24 acid gas emissions.

25 Correct?

1 A. I agree with that.

2 Q. And then highlighted at the bottom of
3 the page is the statement:

4 It could very welcome to pass that
5 beyond economics, beyond dependability
6 beyond energy security, the greatest
7 overall benefit of nuclear energy will be
8 to our environment, an environment
9 gravely threatened by the accumulated
10 effects of years of burning fossil fuels.
11 And that statement is there; isn't it?

12 A. That statement is there, yes.

13 Q. And on the next page where we discuss
14 tomorrow's environment we see at the top of the page:

15 Ontario Hydro turned to nuclear energy
16 for one major reason, to cut its
17 dependence on energy sources such as coal
18 and oil.

19 And then dropping down a paragraph --

20 A. Maybe I should comment on that.

21 I think Hydro turned to nuclear energy
22 for many reasons, one of which was that we had
23 indigenous resources, both technical and from the point
24 of view of fuel.

25 Q. And that remains true?

1 A. Yes, it does.

2 Q. And then dropping down the paragraph:

3 In the past, the nuclear versus coal
4 debate has generally hinged on economics.

5 And we talked a lot about that, you and

6 Mr. Heintzman.

7 Then it goes:

8 More and more, however, the argument
9 is turning away from economics and
10 focusing on how much (or how little)
11 damage each does or might do to our
12 environment. Acid gas emissions from
13 coal burning presents a serious threat to
14 our lakes and forests, and while
15 scrubbers can help reduce these
16 emissions, the technology is expensive
17 and poses environmental problems of its
18 own.

19 Correct?

20 A. Well, I would comment that a lot of
21 these paragraphs in my personal view reflect the
22 thought in 1988. I am not quite sure whether the
23 thought would be precisely phrased this way today.

24 Q. That's what Ontario Hydro was telling
25 the public in 1988, though.

1 A. That's quite correct.

2 Q. Even more menacing than acid rain,
3 however, is the greenhouse effect. This
4 phenomenon is now recognized as perhaps
5 the most serious environmental threat in
6 the history of mankind.

7 And that's what Ontario Hydro was telling
8 the public in 1988?

9 A. Well again, there has been a great
10 deal of effort and improved understanding of the
11 greenhouse effect in the world, that threatens the
12 world, and I am sure that Panel 8 provided information
13 that's up-to-date on that subject. I think they did
14 anyway.

15 Q. But this is what Ontario Hydro was
16 telling the public in 1988?

17 A. That's correct.

18 Q. And over on the next page, on page 9,
19 the final paragraph:

20 In normal operation, nuclear
21 generating stations are almost completely
22 non-polluting to both air and water, and
23 while the problem of final disposal of
24 used nuclear fuel has yet to be resolved,
25 it is minimal compared with the very real

1 threats posed by acid rain and the
2 greenhouse effect.

3 And that's what Hydro was telling the
4 public in 1988?

5 A. Yes, it was, and it reflected
6 understanding at that time.

7 Q. With respect to nuclear generating
8 stations you don't have any different view today, do
9 you?

10 A. Not with respect to nuclear
11 generations stations. Most of my comments reflect on
12 other issues that I find in this booklet. For example,
13 it's now widely accepted throughout the world that we
14 don't expect a 4-1/2 degree Celsius rise in average
15 temperature by the year 2050. Improved models have
16 shown that that's not the case.

17 Q. But Ontario Hydro continues to have
18 great concern about the matter of global warming; does
19 it not?

20 A. Well, everybody considers it a
21 concern and wants to act prudently to avoid it, or
22 minimize it.

23 Q. All right. Then over at page 13 we
24 have the heading A Canadian Industry, and Ontario Hydro
25 is telling the public:

1 Few people are aware of the enormous
2 contribution the nuclear industry makes
3 to the Canadian economy.

4 And to summarize, it provides about
5 100,000 jobs. It's lead by AECL and Ontario Hydro, but
6 also includes a broad spectrum of private sector
7 companies.

8 Every CANDU built and operated in Canada
9 is 90 per cent Canadian, with components supplied from
10 across Canada, and the industry is also a key exporter;
11 correct?

12 A. I think I would agree with all those
13 comments.

14 The last comment I presume is referring
15 to the export of uranium. Canada is a major world
16 exporter of uranium. I don't think that we could claim
17 to be a key exporter of nuclear equipment, for example.

18 Q. Well, the booklet goes on to say:

19 Canada has in the past gained
20 substantial export earnings through sales
21 of CANDU reactors to other countries.

22 A. That's quite true.

23 Q. And with a new line of smaller, less
24 expensive reactors, Canada is well
25 positioned to reap a sizable share of the

1 world market for nuclear reactors. This
2 will provide Canadians with yet another
3 return on their investment in nuclear
4 power.

5 And with the Korean developments that
6 remains true today, too, doesn't it?

7 A. That's one example. I imagine that
8 when this was written they were referring to the
9 Slowpoke reactor, perhaps, when talking about smaller
10 reactors, or maybe CANDU 3.

11 Q. I see the photograph immediately to
12 the right is of a Canadian-made calandria for Wolsong
13 nuclear reactor in Korea.

14 A. That's correct.

15 Q. And finally:

16 As well with the CANDU's exemplary
17 safety record, Canada's expertise in
18 nuclear energy from building plants to
19 designing safeguards is becoming a highly
20 marketable commodity in other countries
21 that use nuclear energy.

22 And that was so in 1988?

23 A. I think in 1988 there was high hopes
24 for gaining orders for CANDUs abroad. I don't know
25 whether our hopes are quite as high as then, but...

1 Q. Well, the Korean developments have
2 been encouraging in recent times, haven't they?

3 A. In recent times, yes.

4 Q. And it's my information that as of
5 this morning this document was currently being handed
6 out at the information centres at Pickering and Bruce
7 stations, and that it's also available from the public
8 reference centre at Hydro's head office here in
9 Toronto. You wouldn't disagree with that?

10 A. I asked Dr. Whillans to look into
11 that.

12 DR. WHILLANS: A. I think what you say
13 is probably correct.

14 This document has been rewritten and it
15 will be replaced as of the end of this month, but as of
16 today you are right.

17 MR. HAMER: I am glad I asked you about
18 it today.

19 Thank you very much, gentlemen, you have
20 been very patient.

21 Mr. Bullock, do you want to start now or
22 do you want to take some time to get organized.

23 MR. BULLOCK: Could we perhaps take a 20
24 minute break, Mr. Chairman, I will bring my papers up
25 and Ms. Findlay and Mr. Hamer can tidy up, and we will

1 be ready to go.

2 THE REGISTRAR: This hearing will recess
3 for 20 minutes.

4 ---Recess at 3:10 p.m.

5 ---On resuming at 3:35 p.m.

6 THE REGISTRAR: Please come to order.
7 This hearing is again in session. Be seated, please.

8 MR. B. CAMPBELL: Mr. Chairman, I've
9 provided in eight copies to Mr. Lucas, a response to
10 Dr. Connell's question regarding the Elliot Lake
11 uranium contract extensions.

12 There was a question asked, and I think
13 the transcript reference is given on the page, it was
14 as of March 25th, there's an answer provided and the
15 press releases that went out at the time the contracts
16 were extended are attached as well.

17 And again, Dr. Connell, if you find you
18 would like more detail or whatever, just let us know.

19 But if we could get an exhibit number for
20 this, I think it should be filed, we did not have an
21 undertaking number for it.

22 THE REGISTRAR: 567.

23 THE CHAIRMAN: Thank you.

24 ---EXHIBIT NO. 567: Response to Dr. Connell's question
25 regarding the Elliot Lake uranium
contract extension.

1 MR. B. CAMPBELL: Thank you, Mr.
2 Chairman. There are -- people, I see, have seen the
3 copies already.

4 DR. CONNELL: Thank you, Mr. Campbell.

5 THE CHAIRMAN: Mr. Bullock.

6 MR. BULLOCK: Mr. Chairman, gentlemen of
7 the panel, Members of the Board, perhaps I could just
8 take a moment, Mr. Chairman.

9 My name is Lex Bullock, I practice with
10 the firm of Borden and Elliott and, Mr. Chairman, we
11 heard a little bit about the Canadian Nuclear
12 Association earlier on, but I thought I might give the
13 Board and the members of the panel a little bit of
14 background about the association, if I could. It will
15 just take but a moment and it might give the Board an
16 idea of what the association is all about.

17 The Canadian Nuclear Association is a
18 non-profit voluntary membership body, it was
19 established in 1960 to promote the orderly and sound
20 development of nuclear energy in Canada for purposes
21 other than those related to armament. It's also
22 involved in activities abroad as well.

23 The Association is composed of many
24 industries and enterprises sharing a common interest in
25 the development and application of nuclear energy for

1 peaceful purposes. The Association's membership
2 includes uranium producers, reactor manufacturers,
3 electrical utilities, engineering companies, banks,
4 employee unions, departments of federal and provincial
5 governments, and educational establishments and
6 institutions.

7 The objectives, Mr. Chairman, Members of
8 the Board, of the Canadian Nuclear Association are to
9 create and foster an environment favourable to the
10 healthy growth of the sound applications for nuclear
11 energy in radioisotopes, to encourage cooperation
12 between various industries, utilities, educational
13 institutions, governments and agencies and other bodies
14 which have a common interest in the development of
15 economic uses for nuclear power in radioisotopes.

16 Thirdly, to provide a forum for the
17 discussion and resolution of problems and concerns to
18 the members, to the nuclear industry, and to the
19 Canadian public in general.

20 And, fourthly, to stimulate cooperation
21 between other associations like the Canadian Nuclear
22 Association with similar objectives and purposes.

23 An idea of the membership, Mr. Chairman,
24 Members of the Board. Current membership of the CNA
25 spans a highly diversified spectrum of endeavour. Most

1 corporate members either presently are suppliers of
2 products and services to the nuclear field,
3 manufacturers, uranium producers, engineering
4 companies, consultants, users of nuclear energy like
5 the electrical utilities and, of course, the federal
6 and provincial government departments and agencies that
7 we mentioned.

8 There are also, sir, Members of the
9 Board, financial institutions, insurance companies and
10 various individuals who are also members of the
11 association.

12 So that's just a little bit of background
13 about the Canadian Nuclear Association, sir.

14 Areas of cross-examination, Mr. Chairman,
15 if I might sum up, I have done some considerable
16 whittling following the very thorough
17 cross-examinations of Mr. Heintzman and Mr. Hamer.

18 I have broken it out, sir, into
19 approximately six basic areas. There are certain
20 preliminary points and points for clarification from
21 previous evidence.

22 I want to take the Board through an
23 interrogatories brief, interrogatory answers that were
24 provided to CNA and ensure that the Board can rely on
25 those, and I'll do that through the witnesses, Mr.

1 Chairman. If there are any questions about that, we
2 can deal with them.

3 Because I must confess, I'm a little bit
4 concerned about what the Board is relying on and what
5 they aren't, but I presume that the answers to
6 undertakings received from Ontario Hydro would be
7 relied upon by the Board. Is that fair?

8 THE CHAIRMAN: Yes. What we have said up
9 to now is that if those undertakings are referred to in
10 the evidence and they are put on the list that have
11 been attached to each witness panel, at least witness
12 Panel 3 in any event, that that would be regarded as in
13 effect reading in discovery; whereas, the ones that
14 aren't so referred would be treated as discovery and
15 technically would not be part of the evidence.

16 MR. BULLOCK: Yes.

17 THE CHAIRMAN: But even the slightest
18 reference to it has the effect of pulling the whole---

19 MR. BULLOCK: That's what I had
20 anticipated, sir.

21 THE CHAIRMAN: --interrogatory into the
22 net.

23 MR. BULLOCK: I had anticipated that you
24 would want it done reasonably quickly and expeditiously
25 much like reading in answers for discovery at a civil

1 proceeding.

2 THE CHAIRMAN: Yes.

3 MR. BULLOCK: That's what I intend to do.
4 That would be the second area.

5 The third area, Mr. Chairman, is really
6 to explore a little bit more the characteristics of the
7 4 by 881 CANDU "A" option and some of the other CANDU
8 options that were talked about and to try to integrate
9 some of that information into chapter 14 in Exhibit 3,
10 the DSP report.

11 I found the DSP report generally, Mr.
12 Chairman, to be quite logically organized and I thought
13 that integrating that might be of some assistance.

14 There are certain health and safety
15 questions that I would like to pose, many of those were
16 dealt with by Mr. Hamer and I have whittled where I
17 can.

18 Natural environment, and I would like to
19 particularly deal with some of the cumulative effects
20 of additional CANDU options being brought into service.
21 I think that is perhaps an area that has been touched
22 upon but not explored in particular detail, and the
23 questions are quite short, Mr. Chairman, and I think
24 deal with some of the cumulative effects, for instance,
25 on the Great Lakes that additional CANDU options might

1 have.

2 And, finally, a few questions about used
3 fuel and disposal and storage questions.

4 Now, with respect to the other areas, I
5 intend to rely very much upon the information elicited
6 by my friends Mr. Heintzman and Mr. Hamer.

7 CROSS-EXAMINATION BY MR. BULLOCK:

8 Q. And perhaps if I could start, Mr.
9 Penn, with you, a question dealing with capital costs.
10 And I believe in your evidence-in-chief you had
11 mentioned that the costs of this kind of hearing are
12 included in the capital costs as part of the dry
13 capital costs; is that right?

14 MR. PENN: A. That's correct, for our
15 future nuclear plants, yes.

16 Q. Exactly. And how are the costs of a
17 hearing like this one apportioned?

18 A. I'm sorry, do you mean how much have
19 I allowed?

20 Q. That's right.

21 A. Approximately \$45-million.

22 Q. All right. And if we talk about the
23 cost of this hearing as being a particular figure "x"
24 dollars, what percentage of that, of the costs of this
25 hearing have been apportioned to the nuclear options;

1 all of it?

2 A. I haven't apportioned any cost for
3 this particular hearing to a future nuclear station.

4 Q. How about any hearing, how are the
5 costs of any hearing apportioned, a particular hearing
6 apportioned; is there a breakout, is there a percentage
7 to hydraulic, a percentage to fossil, a percentage to
8 nuclear of the cost of a particular hearing, or how is
9 it done?

10 MR. PENN: A. I'm not quite sure. The
11 only hearing that I'm familiar with before was the
12 Bruce to Essa transmission line, and I'm quite sure
13 that that hearing cost was capitalized to that line.

14 Q. All right. And the costs of this
15 hearing have not been included in the calculations
16 then. So did I understand you correctly?

17 A. Not been included in the numbers that
18 I've presented at this hearing.

19 Q. Not at all.

20 THE CHAIRMAN: You made a reference to a
21 figure. What was that figure about? What was that
22 attributed to or allocated to, you referred to
23 \$45-million.

24 MR. PENN: That would be in the
25 Interrogatory 9.44.2, which is the preliminary nuclear

1 options review, in calculating or estimating the dry
2 capital cost, one of the components.

3 THE CHAIRMAN: Dry capital cost for what?

4 MR. PENN: For, shall we say, a 4 by 881
5 megawatt station.

6 THE CHAIRMAN: All right.

7 MR. PENN: Part of the approvals process,
8 which includes the Environmental Assessment Document,
9 is the hearing itself, and we have estimated a cost of
10 \$45-million for such a site-project hearing including
11 intervenor funding.

12 THE CHAIRMAN: So you are really talking
13 about the site-project to the hearing?

14 MR. PENN: Yes, I am, sir.

15 MR. BULLOCK: Q. And what about the
16 costs of this hearing, Mr. Penn, are they in a special
17 category somewhere, have they not been included in that
18 calculation.

19 MR. PENN: A. I haven't included them
20 and I'm afraid I can't answer the question on where
21 they have been budgeted.

22 MR. BULLOCK: Okay. Well, perhaps my
23 friend Mr. Campbell can look into it. I'm really
24 trying to ascertain what percentage of the cost of this
25 hearing has been apportioned to the CANDU options in

1 calculating the capital costs?

2 MR. B. CAMPBELL: Well, I think Mr. Penn
3 has answered that question in that none of the costs of
4 this hearing have been allocated in the costs that he's
5 spoken to in terms of the CANDU options.

6 MR. PENN: That's correct.

7 MR. B. CAMPBELL: I think there was a
8 brief reference in Panel 3 at one point as to how the
9 costs of this hearing hit Hydro books, but the simple
10 answer to your question is, they are not reflected in
11 the CANDU costs.

12 MR. BULLOCK: Perhaps I could turn then
13 again, points of clarification of evidence, Mr.
14 Chairman.

15 Q. Mr. Daly, to you, and to Exhibit 519,
16 page 70, which is the chart with some of the OM&A
17 figures.

18 MR. DALY: A. I have that.

19 Q. All right, sir. What I would like to
20 do, if I could, is just summarize your evidence on a
21 couple of points and then ask you some questions about
22 the chart, if I could.

23 A. Certainly.

24 Q. Now, sir, I understood you to say
25 that proper levels of OM&A spending were very important

1 to maintaining optimal nuclear performance; is that
2 fair?

3 A. That's correct.

4 Q. All right, sir. And I understood you
5 to say that the operations group - and I may have the
6 terminology incorrect, and please correct me if I make
7 errors like that - the operations group during the
8 period of budget restraints which are shown on the
9 chart, had consistently been recommending, I would call
10 it, higher levels of OM&A spending, but I guess perhaps
11 the better term would be constant, a constant level of
12 OM&A spending; is that fair?

13 A. That's essentially correct. The
14 group has gone by different names, but I think we can
15 call it the nuclear operations group for simplicity.

16 And certainly during that period we were
17 asking for, you know, typically 5 to 10 per cent beyond
18 the levels we eventually received.

19 Q. That figure was gradually eroded
20 during that -- OM&A spending was gradually eroded
21 during that period in the early 1980s?

22 A. Yes, as Mr. Penn's figure on page 70
23 shows in constant to '92 dollars there was that
24 decrease between about 1981, '82, flattening off around
25 1986.

1 Q. All right. And then if we look at
2 the OM&A spending for the period during the late 1980s,
3 you were certainly pleased, I would take it, with the
4 higher OM&A spending; is that fair?

5 A. Yes, we were. By that time we had
6 presented a case to the Hydro management in 1988 that
7 we have previously discussed with AECL and that led to
8 significant increases in resources and staffing and
9 with smaller amounts in the following years.

10 So the situation over the last two or
11 three years has become much healthier from our point of
12 view.

13 Q. All right. And although the
14 rationale may be a rough one, I think it's probably
15 like the old cliché; isn't it, you can sort of pay me
16 now or you can pay me later. Isn't that the kind of
17 rationale that's applied with OM&A spending?

18 A. Generally speaking I would agree,
19 yes.

20 Q. All right. And could you give us an
21 example -- I want to explore what is meant by budget
22 restraints a little bit, and perhaps you can just tell
23 me, when we look at the figure taking a downturn on the
24 graph, what did that involve, what kind of budget cuts
25 were made or were being made?

1 A. Well, during this time we were of
2 course adding to the system, we were adding Pickering
3 "B", Bruce "B", and we were basically not getting the
4 level of operators and maintainers that we would have
5 ideally liked, so it tended to be that we did not get
6 the staff we wanted and certain -- primarily staff, I
7 would say, certain projects were cut, but our main
8 concern was on the level of staff to be able to keep up
9 with maintenance and to provide the operators where
10 needed.

11 Q. Maintenance tradespeople for
12 instance?

13 A. Maintenance tradespeople, what we
14 call control maintainers, mechanical maintainers
15 primarily.

16 Q. All right. And how about equipment
17 and perhaps hard dollars for, I don't know -- gaskets
18 and those kinds of pieces of equipment?

19 A. There would be some projects cut.
20 Typically cut would be development-type projects,
21 projects which had more of a longer term payoff which
22 we felt were essential to, you know, improve our
23 ability to, say, repair things like steam generators
24 and generators and turbines and so on.

25 So some of the equipment which appeared

1 to have a potential longer term payoff was not funded.

2 Q. Okay. You mentioned the figure of 10
3 per cent. Would that have been 10 per cent per year
4 less than you would have recommended or than your group
5 would have recommended?

6 A. I was just giving an order of
7 magnitude there. It would vary from year to year, but
8 my recollection was during that period we would
9 typically provide a plan and we would ask to look at
10 the implications of a 5 to 10 per cent cut and in many
11 of these years that turned out to be the case.

12 Q. Could you explain that process to me
13 then? You would have made a recommendation about
14 certain OM&A spending levels; would you not?

15 A. Yes. Typically our process is in the
16 early part of the year say around April/May we will
17 prepare a business plan and senior management will look
18 at this during the June/July period and come back with
19 certain comments, recommendations, concerns, and these
20 are addressed by the nuclear operations branch during
21 the September/October period, and shortly after that
22 the budget is firmed up and there is a decision on what
23 the exact level of funding is, and then typically at
24 the January Hydro Board meeting a budget is approved.

25 So essentially it leaves us around

1 October/November, it leaves the operating group.

2 Q. So it would be the Hydro Board then
3 that would be establishing that budget for you?

4 A. Well, they eventually approve it, but
5 of course it goes through many--

6 Q. Review processes.

7 A. --reviews within the nuclear
8 operations branch, our own management, and then forward
9 to the president and so on.

10 Q. Would the government of the day have
11 had any input into that process at all?

12 A. I'm personally not aware of any.

13 Q. Mr. Penn or other members of the
14 panel?

15 MR. PENN: A. I don't think the
16 government, in my knowledge participates in the OM&A
17 process. It may very well participate in capital
18 restraints if borrowing in the province is high, but
19 not OM&A.

20 Q. That's what I'm asking. I'm asking
21 whether in that budget review and formulation process
22 if the government of the day would have had some input
23 into that process leading to perhaps lower overall
24 spending or specifically lower OM&A spending,
25 if the government of the day would have had input?

1 A. My answer is I don't think the
2 government influences the decisions on the level of
3 OM&A spending.

4 Q. Is it your understanding then, Mr.
5 Penn, that there would have been no communication
6 between the government of the day and Ontario Hydro
7 management and Board about that particular issue, the
8 budget restraints?

9 A. I don't think so, not directly with
10 the government, in my knowledge anyway. Obviously the
11 jurisdiction under which costs are reviewed every year
12 is the Ontario Energy Board and certainly OM&A
13 spending, amongst all costs, are reviewed there.

14 Q. And so would it have been the Ontario
15 Energy Board that would have made the final
16 determination then about the global budget?

17 A. No, I don't think so.

18 THE CHAIRMAN: The Energy Board doesn't
19 make determinations, it makes recommendations.

20 MR. BULLOCK: Quite so. An appropriate
21 distinction, sir.

22 Q. Would it have been the Ontario Energy
23 Board, Mr. Penn, that would have made the
24 recommendations about the final budget then?

25 I'm trying to understand who had input

1 into these budget restraints, input into the
2 decision-making process.

3 MR. PENN: A. The OEB may well make
4 observations, but in my knowledge the OM&A budget is a
5 matter for internal review and the executive committee
6 of Ontario Hydro really, I think, reaches the
7 recommendation that is put to our Board for approval.
8 I don't know if Mr. Daly has any more on that.

9 MR. DALY: A. There is just one point
10 I'll add to that. The OEB report comes out at the end
11 of August and while Hydro is finalizing its budget
12 during the September/October period, the
13 recommendations and comments of the OEB are taken into
14 account.

15 Q. I take it, Mr. Daly, that the
16 position that's taken to the Ontario Energy Board for
17 presentation to that Board would be the position
18 arrived at by Ontario Hydro management; is that favour?
19 [3:55 p.m.]

20 A. That's correct. But typically what
21 is taken to the Ontario Energy Board is the position
22 arrived at in April/May of the year while we are
23 preparing the budget and business plan. So in that
24 sense it's maybe six to nine months from the time that
25 we strike the final budget, and it is deliberately so

1 because we want the Ontario Energy Board's comments on
2 our proposed rates and proposed budgets and business
3 plan, and we receive that in early September and do
4 take it into account.

5 Q. And to your knowledge or to your
6 knowledge, Mr. Penn, or any other member of the panel,
7 what were the OEB's comments on OM&A restraints,
8 reductions?

9 A. I was not personally involved with
10 the OEB in the early 80s. I have been involved in the
11 late 80s, and they did express some concerns on the
12 level of funding. But the more recent comments were at
13 a time where we had already recognized it ourselves and
14 were taking corrective actions. I can't speak for the
15 earlier OEB hearings in the early 80s.

16 Q. So during the mid to late 80s the OEB
17 was expressing concern that OM&A rise; is that right?

18 A. The expressions of concern, some were
19 from the OEB, some were from particular intervenors,
20 and some intervenors were more concerned than others.

21 I would say in general the OEB concerns
22 were more about the increases in backlogs, the
23 maintenance work that was not done. How we chose to do
24 that, by increasing funding or working in a different
25 way, I don't recall so many comments on that. But

1 there was concern, there was concern about the
2 deteriorating performance, certainly.

3 Q. Because I take it then the OEB
4 comments on the budget in a global way then with
5 specific recommendations as you mentioned about
6 particular concerns, they don't set the level of OM&A
7 spending as I think the Chairman pointed out.

8 A. They don't, that's correct.

9 Q. And during the mid to late 1980s
10 then, the OEB, as I understood your evidence, was
11 raising concerns that OM&A spending levels rise because
12 of concerns about the maintenance of the equipment and
13 things that you mentioned; is that right?

14 A. . What I talk about the OEB I include
15 the comments by the various intervenors as well, and I
16 have some difficulty in recalling whether a particular
17 comment was made by the Board itself or a particular
18 intervenor, but there were a number of concerns raised.
19 And particularly I believe it was 1988 where there was
20 a special, the OEB called a special review of the
21 production branch and went into, in some detail, the
22 maintenance backlogs and the growing number of backlogs
23 we had.

24 So I think that indicates the level of
25 concern at the OEB, that in 1988 they had that topic as

1 a special review during the hearing that year.

2 Q. I appreciate that. Thank you.

3 I just want to confirm then, Mr. Penn,
4 your understanding, and your understanding, Mr. Daly,
5 and I just wasn't quite sure, Mr. Penn, if you said you
6 didn't know whether the government of the day had input
7 into the lower OM&A spending or whether to your
8 knowledge there were no such communications. Could you
9 assist me with that?

10 MR. PENN: A. I think I said that I
11 didn't think they had, and quite frankly I don't know.

12 Q. Mr. Daly, would you have any
13 knowledge about that?

14 MR. DALY: A. No, I don't. And perhaps
15 just to clarify a previous comment. That OEB special
16 hearing I was referring to was either 1987 or 1988.

17 Q. We see shortly after that period a
18 fairly marked climb in OM&A spending on page 70; is
19 that correct?

20 A. That's correct, yes.

21 Q. Mr. Daly, I want to show you a sheet
22 that deals with some export statistics.

23 THE CHAIRMAN: The source of this, Mr.
24 Bullock?

25 MR. BULLOCK: The source of it is

1 Statistics Canada, I am given to understand, Mr.
2 Chairman. It was prepared, if you want to put a date
3 on it, in March of 1992.

4 MR. B. CAMPBELL: If it's a Statistics
5 Canada figure, I don't think very much turns on it, but
6 is it Ontario or Ontario Hydro? There are other
7 producers who export in Ontario.

8 MR. BULLOCK: I believe it's Ontario
9 Hydro, Mr. Campbell, if you look in the top left,
10 second line.

11 So perhaps we could call it Ontario Hydro
12 Exports and Imports 1980 to 1990 Statistics Sheet, Mr.
13 Chairman, and mark it as the next exhibit.

14 THE CHAIRMAN: It is number?

15 THE REGISTRAR: I can't hear you.

16 MR. BULLOCK: I said perhaps we could
17 mark it as the next exhibit, Mr. Lucas, we can call it
18 the Ontario Hydro Exports and Imports 1980 to 1990
19 Statistics Sheet

20 THE REGISTRAR: 568.

21 ---EXHIBIT NO. 568: Document entitled Ontario Hydro
22 Exports and Imports 1980 to 1990
23 Statistics Sheet.

23 MR. BULLOCK: Q. Do you have the figure,
24 Mr. Daly..

25 MR. DALY: A. I do.

1 Q. And Mr. Penn, you may have some
2 information about it. Do you have...

3 MR. PENN: A. Yes, I do.

4 Q. You see at the top it's entitled
5 Ontario Hydro Exports and Imports 1980 to 1990 in GWH,
6 I take it that would be gigawatthours.

7 MR. DALY: A. That's correct.

8 Q. And there are seven columns, the
9 first column shows the year, second column shows
10 exports, and then there are two below that, province
11 U.S., and then we have a column imports, province U.S.,
12 and then net with U.S. and then overall.

13 Again, those units would be in
14 gigawatthours; is that correct, Mr. Daly?

15 A. Correct.

16 Q. Are you familiar with these kinds of
17 statistics?

18 A. Yes, I received this early this
19 morning so I have had a chance to have a quick look at
20 it.

21 Q. You are familiar with these kinds of
22 statistics?

23 A. Generally familiar, yes.

24 Q. Mr. Penn, you as well?

25 MR. PENN: A. They are the sort of

1 numbers that our power system operating division have
2 responsibility for. I am aware of the trends. I
3 certainly can't vouch for the accuracy of these
4 numbers.

5 Q. Okay. Mr. Daly, do you have enough
6 information to be able to confirm that the numbers are
7 in the right ranges?

8 MR. DALY: A. I can confirm that the
9 trends shown here are generally correct. These
10 numbers, as far as I can see, don't represent our
11 actual sales and purchases, but they are more likely to
12 reflect the actual flows across the tie lines in both
13 directions, and of course we get some flow of
14 electricity for which there is no sale or no purchase,
15 and that appears to be the case on a quick look at it.

16 So with that understanding, what I am
17 more familiar with is the sales and purchases, but
18 certainly the general trend is reasonable.

19 Q. And with respect to the general trend
20 then, could you explain your understanding of what it
21 is, what the general trend is?

22 A. I think the general trend shows that
23 our exports to the U.S. have been declining since 1980,
24 and were particularly low in 1990. And our imports
25 from the U.S. have been generally increasing, but with

1 a very marked peak in the year 1990.

2 I draw your attention to two factors:

3 One, in recent years the acid gas restraints on our
4 fossil stations have effectively put a cap on our
5 fossil stations, we can only operate them up to a
6 certain level, as limited by the acid gas restrictions.
7 So once we reach or come close to that limit we can no
8 longer operate the fossil station, so that limits the
9 amount of production they can put out on an annual
10 basis.

11 Q. Just to make sure I understand that
12 then. Because of the acid gas restrictions and
13 regulations in this province, when you approach that
14 level you then have to curtail fossil generation and
15 purchase the power from the U.S.; is that correct?

16 A. That is one scenario, yes.

17 Obviously we look ahead so we don't sort
18 of find ourselves in the situation at the end of the
19 year where we have to suddenly curtail fossil, so we
20 look ahead and plan ahead.

21 But in cases where you are coming close
22 to that fossil limit and you, say, have no more nuclear
23 production or hydraulic production that you can get,
24 yes, you have to purchase.

25 As you can see in 1990 we had to purchase

1 extensively. We had a number of nuclear units down
2 that year for several months and that led to quite
3 heavy purchases in 1990. The situation has largely
4 restored itself to more normal figures in 1991.

5 Q. Would it be fair to say that
6 particularly with reference to 1990 but perhaps during
7 the late 1980s as well, did the budget restraints shown
8 on page 70 of Exhibit 519 for OM&A, did those
9 contribute to those large imports?

10 A. I would say they contributed
11 partially.

12 As I mentioned earlier I think in
13 discussing it with Mr. Heintzman, we feel that the OM&A
14 restraints have had a negative impact on nuclear
15 performance since about 1982/83 until the late 80s
16 certainly. However, there were other factors such as
17 pressure tube failure at Pickering and the steam
18 generator work at Bruce "A". So it would not be fair
19 to attribute all of these imports to reduced OM&A; it
20 would certainly be one factor, however.

21 Q. A fairly significant factor, would
22 you say?

23 A. I would say significant but more at
24 the sort of 20, 30 per cent level, not sort of more
25 than 50 per cent. That order of magnitude.

1 Q. So would it be fair to say that the
2 range of contribution would have been 20 to 50 per
3 cent, somewhere in that area?

4 A. Again I wouldn't advise anybody to
5 use those figures for a calculation. I am just trying
6 to sort of get you in the right sort of area.

7 So I would put it more around 20 to 30
8 per cent. I would not take it as high as 50 per cent.

9 Q. But the order of magnitude would be a
10 quarter?

11 A. That order of magnitude with a bit of
12 a range on it, yes.

13 Q. Could you give us an idea of what the
14 cost of power imports was in 1990? My understanding
15 was it was in the range of \$25 to \$30 a megawatthour.
16 Is that about the right range?

17 A. That's about the right average range.
18 At times we were up to \$40 per megawatthour.

19 Q. So, if we were to use the figure of
20 \$30 a megawatthour, we would be pretty accurate?

21 A. That would probably be a reasonable
22 average. The more power you have to import, generally
23 speaking, the more expensive it tends to be.

24 Q. And you mentioned that the figures in
25 Exhibit 568 are not exactly the purchases and sales; is

1 that right?

2 A. That's correct. It's my
3 understanding that Hydro has already tabled on Panel 2
4 some of the sales and purchases values and those can be
5 found in interrogatories 2.7.60 to 2.7.64.

6 I haven't personally examined those, but
7 it's my understanding that the sales purchase values
8 have been provided there.

9 THE CHAIRMAN: Are those two
10 interrogatories or a series of interrogatories?

11 MR. DALY: They are a series.

12 MR. BULLOCK: 2.7...

13 MR. DALY: 2.7.60, extending to 2.7.64.

14 MR. BULLOCK: Q. Inclusive?

15 MR. DALY: A. Yes. It's my
16 understanding that these include historic sales and
17 purchase values.

18 THE CHAIRMAN: Perhaps we better give
19 that a 520 number.

20 THE REGISTRAR: 2.7.60 is .44.

21 THE CHAIRMAN: I have got 2.7.60, 2.7.64
22 inclusive; is that correct.

23 MR. DALY: That's correct.

24 THE CHAIRMAN: It's a series. We can
25 just have one number.

1 THE REGISTRAR: .44.

2 ---EXHIBIT NO. 520.44: Interrogatory Nos. 2.7.60 to
3 2.7.64, inclusive.

4 MR. BULLOCK: Q. I am happy to look at
5 those over the weekend, Mr. Daly, and come back to you
6 if you like. But are you able to tell us of the 13,478
7 gigawatthours shown as being net imports in 1990, are
8 you able to give us an idea of what proportion of that
9 or what percentage of that was actual, I guess it would
10 be purchases, wouldn't it?

11 MR. DALY: A. My recollection is that it
12 was about 10 terawatthours, but perhaps we could
13 include that as subject to check, and if I find it's
14 significantly different from 10, I will advise you.

15 Q. That would be fine.

16 THE CHAIRMAN: 1990 was a special year
17 with a lot of special circumstances which were
18 discussed extensively in Panel 2, I think it was.

19 MR. BULLOCK: Quite so, Mr. Chairman. I
20 am trying to get at the eventual cost of the OM&A, and
21 I believe Mr. Daly said it was about a quarter of the
22 1990 imports and I would just like to do that
23 calculation and then leave off it.

24 THE CHAIRMAN: I think that has to be
25 treated as a very, very rough estimate, if I heard Mr.

1 Daly correctly.

2 As I say, Panel 2 went into all this. I
3 am not sure that this is really the area of
4 cross-examination that this panel has been brought here
5 to do.

6 Mr. Daly seems quite eager and anxious to
7 answer the questions.

8 MR. BULLOCK: He's a very helpful
9 gentlemen.

10 Q. Mr. Daly, just to be clear then, you
11 had said a quarter and you had given a range of
12 something like 20 to 30 per cent of that 1990 figure;
13 isn't that right? You are fairly confident that, are
14 you not?

15 MR. DALY: A. I would not use that
16 figure in 1990. Because in the year 1990 as you can
17 see we have already started to improve the level of
18 resources quite significantly. So I don't think it
19 would be appropriate to apply it to 1990, because by
20 that time we had many of the new staff on board.

21 When I was quoting that figure I was
22 really thinking of the period, more of the period sort
23 of '82 to '87, that type of period where the resources
24 as indicated in Mr. Penn's figure on page 70 were low.

25 Q. I understood you to say that the

1 contribution to 1990 imports of the OM&A budget
2 restraints in the early 1980s was approximately one
3 quarter. Did I not hear you correctly?

4 I am talking about the subsequent effect
5 of the budget restraints in the early 1980s, and I
6 thought you said that for 1990 the contribution to
7 those imports because of the OM&A restrictions had been
8 about a quarter, 25 per cent. Did I misunderstand you?

9 A. I don't recall saying that. I don't
10 recall saying that. Certainly in my mind when we
11 discussed that figure I was thinking of the period of
12 the significant restraint. And this period in 1990, as
13 you can see, we had been coming out of that period of
14 restraint for a couple of years. So if I left that
15 impression I would like to correct it.

16 Q. What I will do over the weekend is I
17 will take a look at the interrogatory answers that you
18 mentioned and we may revisit it Monday morning or
19 Monday afternoon. But I will take a look at those and
20 perhaps that would be a better way of coming at it.

21 A. Sure.

22 Q. I have couple of questions dealing
23 with -- it was number, Mr. Chairman, 520.34,
24 Interrogatory 9.2.115. It's the nuclear moratorium
25 letter. Mr. Hamer and Mr. Heintzman were through this,

1 Mr. Chairman, and I have only a couple of questions
2 about it and they are specific questions and I would
3 ask the Board's indulgence to hear them and see where
4 we go.

5 I have extra copies made if the Board
6 needs them, if members of the panel need them or if any
7 one here needs it.

8 Do you have it, Mr. Chairman, 520.34?

9 THE CHAIRMAN: I think we have it, yes.
10 It's here somewhere.

11 Go ahead. I remember the letter.

12 MR. BULLOCK: Just to refresh everyone's
13 memory, Mr. Chairman, this is the correspondence
14 dealing with the nuclear moratorium, the initial letter
15 to Mr. Franklin from Mr. Eliesen is dated November
16 16th, 1990 and the reply letter is dated November 23rd,
17 1990.

18 Q. My question, I suspect it's to Mr.
19 Penn, or to anyone on the panel would be this: Was
20 there an Ontario Hydro Board meeting held between
21 November 16th and November 23rd, 1990? In other words,
22 was there a board meeting prior to Mr. Franklin's reply
23 of November 23, 1990, or do you know.

24 [4:15 p.m.]

25 MR. PENN: A. Well, I don't really know,

1 but I do know that the Board usually meets on the
2 second Monday of the month, unless there is a special
3 meeting.

4 I really can't help you any further than
5 that general comment.

6 Q. Are there records kept of the Board
7 meetings, Mr. Penn?

8 A. Absolutely.

9 Q. And those minutes, would they be
10 available to this Board?

11 MR. B. CAMPBELL: Board memoranda have
12 been provided on pertinent matters. I would rather
13 like to hear the matter before I make any generalized
14 statements.

15 THE CHAIRMAN: Well, the thrust of the
16 question seems fairly obvious, was there a discussion
17 of a letter from the Deputy Minister of Energy dated
18 November 16th, 1990 prior to the reply by the Chairman
19 on November 23rd, 1990.

20 I think at the moment all Mr. Bullock
21 wants to know is: Was there such a meeting held.

22 MR. BULLOCK: Or did Mr. Franklin reply
23 on his own initiative.

24 THE CHAIRMAN: And this gets into an area
25 we have been in before I think.

1 MR. BULLOCK: It does, but I think the
2 factual question crystallizes the issue.

3 MR. B. CAMPBELL: Mr. Chairman, Mr.
4 Franklin replied to Mr. Ellison's letter conveying the
5 government's new energy policies and, in my submission,
6 the letter speaks for itself and that this Board and my
7 friend have should -- I think the proper way to treat
8 this is that Mr. Franklin would not have written the
9 letter unless he felt he had appropriate authority to
10 do so.

11 And, in my submission, there is no point
12 to be served in these proceedings by inquiring into
13 that.

14 MR. BULLOCK: My submission to you, Mr.
15 Chairman, is this, is that if a letter from government
16 expressing a change in government policy is always
17 going to be determinative of these kinds of questions,
18 then that is the kind of fact that this Board should be
19 aware of when considering things like terms and
20 conditions of an approval of a matter that's been
21 submitted to this Board.

22 And that's my submission to you, is that
23 I'm trying to get at the question whether or not these
24 kinds of letters are determinative of the direction
25 that Hydro would then take and, if they are, I think

1 that that has some very serious implications for final
2 argument about conditions before this Board.

3 THE CHAIRMAN: I'm not sure, whatever the
4 answer might be to the question you have asked, if that
5 would certainly settle how they dealt with this
6 particular issue but how they deal with any future
7 issue, who knows.

8 It's, as you know, a very lively subject
9 of public debate right now is the relationship
10 between--

11 MR. BULLOCK: Quite so, sir.

12 THE CHAIRMAN: --Ontario Hydro and the
13 Government of Ontario and that's a matter which is
14 going on, some of the parties to this hearing are
15 active in that debate in another area, and I am not
16 sure how it is going to help us to know how Mr.
17 Franklin decided to respond to the letter from the
18 deputy minister in the long term.

19 MR. BULLOCK: Well, of course, my next
20 question, Mr. Chairman - this may well have also been
21 posed, certainly it was alluded to by Mr. Heintzman -
22 and that is whether a letter similar to the letter of
23 November 16th, 1990 was provided to Ontario Hydro by
24 the government prior to the issuing of the Update that
25 was provided to the parties on January 15th of this

1 year.

2 I think that that is certainly a question
3 of some concern to my client, of some concern to a
4 number of parties before the Board and I think --
5 again, my submission to you, sir, is that it goes to
6 the issue of what kinds of conditions to any approval
7 ought to be imposed, how involved those conditions
8 might have to be.

9 Again, that's going to be a matter for
10 final argument, but certainly it would be my submission
11 that the Board ought to have the evidence before them
12 about the fact of whether or not this kind of
13 correspondence is determinative of a particular issue.

14 THE CHAIRMAN: Well, excuse me, Mr.
15 Campbell.

16 This may be true. I am not saying this
17 is not an issue which may be of interest to us, but
18 this particular panel is the panel on nuclear
19 generation.

20 I think that the person that should
21 answer that question is the chairman of Ontario Hydro,
22 and perhaps it's a proper question for you to address
23 to him if and when he comes to testify at this hearing
24 or through some other process, but I think that
25 question is a question that the chairman should answer.

1 The panel that's here is really here to talk about
2 nuclear generation and really would not be privy to the
3 details of the relationship between the Government of
4 Ontario and Ontario Hydro.

5 MR. BULLOCK: And my submission to you,
6 sir, is that it's a very straightforward factual
7 question that could be easily ascertained.

8 THE CHAIRMAN: That may be.

9 MR. BULLOCK: I would like the question
10 to stand and if these gentlemen are not able to provide
11 an answer, then I would like my friend Mr. Campbell to
12 undertake to ascertain the fact of the matter, whether
13 or not there was a Board meeting between these two
14 dates.

15 And, as I said, I have a couple of other
16 questions about the Update that I'm happy to pose for
17 the record, and then perhaps my friend Mr. Campbell can
18 make his submissions and we can resolve the matter.

19 Would that be all right, sir?

20 MR. B. CAMPBELL: Well, Mr. Chairman, I
21 took from your remarks that I was not going to be
22 required to make any such inquiries.

23 I can advise my friend that the matter of
24 direction to Ontario Hydro is, of course, dealt with
25 explicitly in a bill that is before the Legislature at

1 this time and I expect within the time frame of this
2 hearing that that legislative issue will be resolved
3 one way or the other.

4 But, again, with respect to this
5 particular letter and its response, in my submission,
6 there is no appropriate reason for this Board to permit
7 any questions as to Mr. Franklin's authority to reply
8 to that.

9 With respect to any other matter that --
10 a question that he may have of government action, the
11 government is a party to this hearing and there's an
12 interrogatory process, why doesn't he use it. It's not
13 fair to put these witnesses in that position. They are
14 in no, as you point out, no position to know.

15 He's got mechanism available to him, why
16 doesn't he use it, it would be his my submission, sir.

17 MS. PATTERSON: And if he does put an
18 interrogatory to you, will you answer it?

19 MR. B. CAMPBELL: I didn't say to me, I
20 said the government is a party here. If my friend is
21 asking questions about what letters the government has
22 written, it surely ought to go to the government.

23 MS. PATTERSON: But it's a broader
24 question than that, it's what happened before Hydro
25 responded as well.

1 MR. BULLOCK: The factual question that
2 started the discussion, and the member, Ms. Patterson,
3 is quite correct is, was there an Ontario Hydro Board
4 meeting between November 16th, 1980 and the reply
5 letter dated November 23rd, 1980, and that surely is
6 not a fact that is within the knowledge of the Ontario
7 Government, that's a fact that is within the knowledge
8 of Ontario Hydro.

9 MR. B. CAMPBELL: I wasn't dealing with
10 that question when I made that submission. My friend
11 also suggested that he was going to be moving on to ask
12 whether there was a similar letter sent by the
13 government with respect to the Update, that's what he
14 said.

15 And if he wants to inquire of the
16 government, I think he should inquire of the
17 government, they are a party to these proceedings.

18 With respect to the first matter though,
19 the original matter as to whether there was a Board
20 meeting, again, in my submission, Mr. Franklin
21 responded to the letter. This Board should not, in my
22 submission, be entering into any kind of inquiry as to
23 whether Mr. Franklin had appropriate authority to give
24 the assurances he did in his response.

25 If we get into that kind of area, we are

1 never going to stop here. I can see it having no value
2 to this Board in doing that, in my submission. I
3 cannot see what relevance it is in the determination of
4 the issues before you.

5 MR. BULLOCK: Well, I do agree with my
6 friend that - I believe it's Bill 118 - that if Bill
7 118 dealing with this issue becomes law, the question
8 may be moot, but the point right now is that it is
9 still a pending bill, it is not law in this province
10 yet and, accordingly, in my submission, the question is
11 relevant.

12 I'm happy to move on, Mr. Chairman. I'm
13 happy to put my other questions about the Update on the
14 record and to hear your ruling, but I think that the
15 question is an important one, and the issue is an
16 important one.

17 MR. B. CAMPBELL: Well, Mr. Chairman,
18 generally on questions of the Update, of course, I have
19 tried to not say the words for several days, but this
20 panel cannot deal with the development of the Update.

21 We have a panel coming up to deal with
22 that. If my friend wants to give notice of the
23 questions, if I believe them to be relevant, I will
24 ensure that there is someone on Panel 10 who can answer
25 them. But that is not the matter that is before us

1 now.

2 THE CHAIRMAN: We seem to have been
3 talking about two different things, one is the question
4 relating to the correspondence back in November of 1990
5 which is one type of question, and then the question of
6 what if any correspondence may have occurred between
7 the Government of Ontario and Ontario Hydro which
8 affected or led to or related to Exhibit 452.

9 Those are two separate kind of questions,
10 and perhaps we should just deal with one at a time.

11 I take it that Mr. Bullock has asked if
12 there was a meeting of the board of directors of
13 Ontario Hydro between the time of the receipt of the
14 letter of November 16th and the time of the reply of
15 the chairman, and Mr. Campbell has objected to that
16 question being answered either by this panel or by
17 anybody else, and is that where we are at at that
18 stage; is that correct, on that particular issue?

19 MR. BULLOCK: Yes, sir.

20 ---Off the record.

21 THE CHAIRMAN: Okay. I just wanted to
22 consult with my colleagues about that one.

23 We will not require Hydro to answer that
24 question.

25 Now, the other matter seems to me - this

1 is not a ruling, this is just a suggestion - that it
2 certainly is a relevant issue for Panel 10, that's
3 leaving aside its relevancy or non-relevancy for Panel
4 9, it would seem to me that that would be the subject
5 matter of an interrogatory and that can then be dealt
6 with by Ontario Hydro.

7 It doesn't seem to be very much different
8 than the kind of answer that they gave to Interrogatory
9 9.2.115, which we have just been referring to, it's
10 dealing with some correspondence between the Government
11 of Ontario and Ontario Hydro, but let's let that fall
12 where it may.

13 I think that's probably the best way to
14 deal with it, Mr. Bullock, rather than ask these
15 panels, because I doubt if they know the answer, and I
16 think we would just waste some time trying to find out.

17 MR. BULLOCK: That's fine, Mr. Chairman.
18 Just so my friend Mr. Campbell, once again with your
19 indulgence, is aware of the question and the question
20 would be again phrased very much in terms of
21 Interrogatory 9.2.115, the question would be: Please
22 provide all correspondence between Hydro and the
23 provincial government related to the Update, Exhibit
24 452. And the follow-up question would be: Kindly
25 advise of the Ontario Hydro board meetings held with

1 respect to the Update and provide the minutes of those
2 board meetings.

3 Just so my friend is aware of the
4 questions and I will now proceed on, Mr. Chairman.

5 THE CHAIRMAN: The Board has a different
6 question. I think the board meetings fall within the
7 same ambit as the previous ruling. We are not going to
8 require Hydro to produce minutes of Board meetings.

9 MR. BULLOCK: That's fine, sir. Then my
10 friend is at least aware of the question and I will
11 certainly provide it to him very shortly.

12 Q. Now, Mr. Penn, I had a couple of
13 questions for you about Darlington and they flow out of
14 Exhibit 539.

15 THE CHAIRMAN: Remind me what 539 is.

16 MR. BULLOCK: Certainly, sir. It is a
17 letter addressed to Mr. or Ms. K. R. Hedges, General
18 Manager, Ontario Hydro Services, it's dated March 20th,
19 1992, its heading is Darlington and it begins:

20 The attached document is an update
21 to the one I sent you on October, 1991
22 and was prepared primarily to answer
23 questions raised by Darlington staff
24 related to articles that have appeared
25 in the press.

1 I believe it deals with Darlington cost
2 overruns and delays, Mr. Chairman.

3 THE CHAIRMAN: All right, go ahead. I'll
4 manage. Just getting near the end of the week,
5 unfortunately.

6 MR. BULLOCK: It is, sir. It is late in
7 the day on the last sitting day of the week and I will
8 be referring to the appendices, so I would like the
9 Board to have the document in front of them.

10 THE CHAIRMAN: Well, I'll look at Ms.
11 Patterson's, and I'll be fine.

12 MR. BULLOCK: Very good, sir.

13 MR. PENN: Fine, I have it now. Thank
14 you.

15 MR. BULLOCK: Q. Very good. Mr. Penn,
16 it's a bit of an arithmetical exercise and I must say,
17 I hesitate to do it this late in the day, but let's
18 give it a try.

19 If I could take you to Appendix 2,
20 Darlington schedule changes.

21 MR. PENN: A. Yes, I have that.

22 Q. And this is the updated appendix, I
23 understand. I had seen an earlier one that had 75 per
24 cent planned scheduled changes and 25 per cent schedule
25 slippage, and this of course shows 70 per cent planned

1 changes and 30 per cent schedule slippage.

2 This is the document, this is the current
3 appendix; is it not?

4 A. Yes, I understand it's updated
5 annually.

6 Q. All right. I would like to determine
7 the dates, Mr. Penn, if there had been no delays when
8 the various units of Darlington could have come into
9 service.

10 Perhaps if we could just run down the
11 list. I have worked them out and I'll give you the
12 figures.

13 THE CHAIRMAN: That's no delays or
14 advances; is that right?

15 MR. BULLOCK: Actually it's net, Mr.
16 Chairman, is what it is. I've used the figures, the
17 net delay figures--

18 THE CHAIRMAN: All right.

19 MR. BULLOCK: --in the right-hand column,
20 sir.

21 Q. So just running down them, Mr. Penn,
22 perhaps -- and, again, the dates that we are using, Mr.
23 Chairman, are the net delay figures in the right-hand
24 column at the top, and then the actual or estimated
25 in-service dates at the bottom of the page.

1 What I have done is then subtracted, if
2 you will, the delay period from the in-service dates to
3 get what would have been the in-service dates if there
4 had been no delays; in other words, if there hadn't
5 been any delays, when would it have been up and
6 running.

7 And, Mr. Penn, just running down the
8 list, Unit 1, 72-month delay, six-year delay, I had it
9 coming in-service in August of 1986. Would that have
10 been right if there had been no delays?

11 MR. PENN: A. Well, I think we should be
12 clear on what we are assuming here. As you can see
13 from Appendix 2 it's split into what is known as
14 planned scheduled change, which is a term used for
15 schedule delay or advance that is not within the
16 control of the Darlington project--

17 THE CHAIRMAN: I'm sorry.

18 MR. PENN: --and scheduled --

19 THE CHAIRMAN: That doesn't make sense,
20 excuse me. It's a planned delay; is that not right, so
21 it must be in control of Ontario Hydro at least if they
22 plan it that way; is that right?

23 MR. PENN: It's within the control of the
24 Board of Directors of Ontario Hydro and perhaps the
25 government.

1 [4:35 p.m.]

2 THE CHAIRMAN: But not the people on the
3 ground.

4 MR. PENN: But it's not a decision made
5 by the project itself, by the project manager of
6 Darlington.

7 THE CHAIRMAN: Right.

8 MR. B. CAMPBELL: It's known as where
9 does the buck stop for this one.

10 MR. BULLOCK: Who is making the
11 determinative decision, Mr. Chairman, that's the issue.

12 MR. PENN: Whereas the schedule slippage
13 is a responsibility of the Darlington project, and
14 therefore, the project manager--

15 MR. BULLOCK: I appreciate that, Mr.
16 Penn.

17 MR. PENN: --on behalf of the
18 corporation.

19 So I think we should be clear on that,
20 because it doesn't necessarily follow that the schedule
21 slippage would not have occurred if the planned
22 schedule hadn't occurred.

23 MR. BULLOCK: Q. I quite agree with you.
24 In fact, I wanted first to explore the question of the
25 net delay column and then I was, in fact, going to take

1 you to the planned schedule changes and deal with those
2 delays.

3 MR. PENN: A. Fine, I just wanted to
4 make sure everyone was clear on that.

5 Q. I think the Board does as well. I do
6 understand the distinction, thank you.

7 A. Thank you.

8 So maybe you would like to ask me the
9 question again.

10 Q. Certainly. I was using the net delay
11 column and the actual or estimated in-service dates
12 from the bottom, I was going to determine the date that
13 Unit 1 would have come into service if there had not
14 been the net delay shown in the appendix.

15 A. Yes.

16 Q. And I had said for Unit 1 we are
17 talking about a net delay of 72 months, which is six
18 years, and I made that to be Unit 1 would have come on
19 stream August of 1986?

20 A. That's correct.

21 Q. And Unit 2, a net delay of 59 months,
22 which I made to be about five years, a month shy, it
23 would have come on stream in October of 1985?

24 A. Correct.

25 Q. And with respect to Unit 3, a 63

1 month net delay, 5-1/4 years, it would have come into
2 service on stream March of 1987?

3 A. Well, not to split hairs with you,
4 but --

5 Q. Am I out by a month?

6 A. I make it May of 1987.

7 Q. That will be fine. May of 1987.

8 With respect to Unit 4, a 61-month net
9 delay, five years and a month, and I had it February or
10 March of 1988 it would have come into service, if there
11 had been no day?

12 A. That's correct.

13 Q. And going to your appendix 3, to
14 Ontario Hydro's appendix 3, if there had not been those
15 delays, and appreciating the distinction between
16 planned and schedule, planned schedule changes and
17 schedule slippage, what would have been the cost
18 savings, Mr. Penn, if the Darlington units had come
19 into service without the delays? And I appreciate that
20 appendix 3, I guess, is done on a global basis; is it?

21 A. Yes, it is.

22 Q. It's not broken out unit by unit?

23 A. It's for the whole station.

24 Q. Right. So would it be fair looking
25 at those dates that we have arrived at, and looking at

1 appendix 3, would it be fair to say that the savings if
2 there had been no delays would be of the order of \$3
3 billion?

4 A. Well, what we are looking at on
5 appendix 3 are sequential cost estimates as the project
6 proceeded and as the design was being completed up from
7 the original definitive estimate in 1981 by which the
8 progress of the project is measured to today, in 1992.

9 So whether you can deduce that around
10 '86/87 that the costs, if they had been completed then,
11 would have been about \$10.8 billion, that in fact you
12 could save \$3 billion is not altogether clear to me at
13 the moment without thinking about this quite a bit
14 more.

15 Clearly, the thing that matters is the
16 interest payment in the main. If you look at appendix
17 5-1, which is the second last page, the schedule delay
18 shown in red --

19 Q. Unfortunately, I don't have a
20 coloured one.

21 A. I could lend you one.

22 THE CHAIRMAN: It's marked at the bottom.
23 Schedule delays, it's the first pillar.

24 MR. PENN: At the bottom of the bar on
25 the left of the chart is called schedule.

1 MR. BULLOCK: Q. Yes?

2 MR. PENN: A. And that is the equivalent
3 of what is called planned schedule change. So that the
4 cost on average, since the planned schedule change for
5 Units 1 and 2 is three years, and for 3 and 4 is 4-1/2,
6 if we say on average that the delay to all units was
7 3-3/4 quarter years, then the cost of that is \$3.3
8 billion in interest.

9 So, I think having gone through that
10 rationale, my answer to you is that you are probably
11 about in the right ballpark, and in fact it's a little
12 bit more.

13 Q. And if we apportion that then and
14 break out the planned schedule changes which were the
15 ones beyond the control of the team as you mentioned,
16 if we had just had those delays instead of the total
17 delays, what would have been saved?

18 Perhaps I put that inelegantly.

19 If there had just been the planned
20 delays, so the 70 per cent of the net figure, is that
21 right, on appendix 2?

22 A. Well, I think I have just answered
23 that question. It would be \$3.3 billion.

24 Q. All right. Thank you.

25 A. You see, the schedule slippage as

1 it's noted in blue on appendix 2, consisting of seven
2 entries, are part of what is called the estimate and
3 scope change. That's their cost.

4 Q. Yes.

5 A. The schedule change is in fact the
6 equivalent of what is called planned schedule change.

7 Q. Yes. And again, to sum up then, the
8 total cost saving as you mentioned would have been \$3.3
9 billion; is that correct, had it been built without
10 delay?

11 A. Yes.

12 Q. And is it possible, Mr. Penn, that in
13 a situation where Darlington had been built without
14 delay, there would have been the opportunity to export
15 some of the power generated by that plant and apply
16 those profits to the sunk costs; would that be
17 possible?

18 A. It may be possible. I don't know,
19 quite frankly. It's a speculative question.

20 Q. Well, generally speaking, if you
21 bring a station into service before there is a need, a
22 domestic need for the power generated from that
23 station, is it not possible that power from that
24 station could be exported and the profits applied as
25 against the sunk costs for that station? Is that not,

1 generally speaking, possible?

2 A. It is possible if there was excess
3 base load to the demand in Ontario.

4 Q. Right.

5 A. Normally what would happen is that
6 for most of the year the demand on the system is higher
7 than the base load capacity, so that what is sold is
8 the fossil generation.

9 Q. And if there were that excess base
10 load capacity then, and there were of course the market
11 for the exports, could those profits have been applied
12 to reduce the sunk costs? Could they have had an
13 effect on the electricity rates for the consumers in
14 Ontario?

15 A. Well, the secondary sales income
16 becomes part of the revenue of the corporation.

17 Q. Right.

18 A. And so, yes, it could affect the
19 forecast rate increase for the following year, but it
20 wouldn't be applied to a specific project.

21 Q. I appreciate that. But overall, it
22 would have brought the rates down then; is that right?

23 A. If that happened, if that scenario
24 had happened.

25 Q. All right. I just want to clarify a

1 point in your evidence then. I had thought you had
2 said to my friend Mr. Heintzman on Monday - and again I
3 had it in my notes and I am just asking you to consider
4 it - I thought you suggested that it was always better
5 not to overbuild a system, and I took from that that
6 you meant not to overbuild it beyond satisfying the
7 domestic need.

8 Was that what you said or did I
9 misunderstand you? That's my recollection. That's
10 from my notes what you had said in response to a
11 question to Mr. Heintzman.

12 A. Well, I think I would have to go back
13 to the transcript of that day to get the context of
14 what the question was.

15 From my memory, we were talking about the
16 reasons for decisions for delays, and one of the
17 reasons that I advanced was that apart from depressed
18 economic conditions was the need to lower borrowing,
19 and I think I probably mentioned that the decision was
20 probably based upon the fact that it was -- that we
21 would overbuild beyond what was forecast given that the
22 load growth had reduced. I think it was in that sense.

23 Q. So you were not suggesting that it
24 was always better not to overbuild. There may be
25 instances, I am suggesting to you, when it would be

1 appropriate to overbuild beyond domestic need; would
2 you agree with that?

3 A. I wasn't either advocating
4 overbuilding or underbuilding. I was merely trying to
5 provide a reason for the reason for the delay in view
6 of the fact that the load forecast had dropped.

7 Q. I appreciate that.

8 The question I am posing to you now is:
9 Would you agree with me that there may be instances
10 where it would be appropriate to overbuild beyond
11 domestic need? There may be instances?

12 A. I think that is a policy for the
13 board of directors of Ontario Hydro rather than my
14 views on the matter.

15 Q. Do you have a personal view on
16 matter?

17 MR. B. CAMPBELL: Well, Mr. Chairman,
18 there are all kind of things in the world that all of
19 us have personal views on.

20 In my submission the matters that should
21 be coming before this Board are matters on which you
22 have opinions expressed by appropriate witnesses.

23 This witness is not - nor is anyone on
24 this panel - responsible for making recommendations
25 with respect to overbuilding or underbuilding, nor has

1 he ever been so to my knowledge within his career. We
2 do have people who do have that responsibility coming
3 up before you and in my submission this question should
4 be deferred to them.

5 MR. BULLOCK: My submission would be, Mr.
6 Chairman, would be that if Mr. Penn, given his broad
7 range of experience has a view, and let us keep in mind
8 that he has been involved, as I understand, with
9 costings for both nuclear and fossil and perhaps other
10 plants as well, if in his experience he has had
11 occasion to consider these kind of issues, then my
12 submission to you would be that it would be appropriate
13 that he would express his view.

14 THE CHAIRMAN: Mr. Penn is not a planner
15 in that nature, it has not been his experience. His
16 personal view might be of very little weight from that
17 circumstance. It would certainly be overridden by
18 different views given by people who are responsible for
19 that at Ontario Hydro.

20 I think you are getting into a very
21 difficult area here. Ontario Hydro is coming here with
22 a position, and I don't say that you never ask, but if
23 you are asking questions about nuclear generation and
24 the characteristics of nuclear generation and what his
25 personal view is, and he has been asked those kind of

1 questions and he has answered them. He said what his
2 personal view is about nuclear generation as opposed to
3 other generation. He has answered those questions and
4 those are proper questions to ask him. But on matters
5 of company policy which he has no direct involvement
6 in, I don't think it's really helpful and perhaps not
7 useful to ask him those kind of questions.

8 MR. BULLOCK: Q. Well then, just one
9 more before I leave the area to you, Mr. Penn. I took
10 it you agreed with me, though, that if the export
11 potential was available, then when you build a
12 facility, the profits from exports from the station,
13 again given the qualifications that you provided, could
14 be used and could be applied against the sunk costs.
15 You agreed with that, didn't you?

16 MR. PENN: A. What I said was that if
17 you take secondary income and you take secondary --
18 well, if you take income and sales -- income and
19 purchases as a net, then this net is either subtracted
20 from, if we are buying more than selling, or added to
21 the revenue of the corporation.

22 Q. Yes.

23 A. And when the expenses of the
24 corporation are taken away from that and the net income
25 is looked at, and the borrowing and the debt, statutory

1 debt is paid, then it may be that the rate increase, if
2 we had positive income from secondary sales, would
3 reduce in the following year. That's all I said.

4 THE CHAIRMAN: That's an overall
5 proposition, the more money you bring in, the better it
6 is to apply it to your cost.

7 The allocation of costs is a matter which
8 was dealt with in Panel 2. The allocation of costs is
9 a very tricky area in the utility, and it goes to
10 accounting and determining rates, and all kinds of
11 things, it's quite a sophisticated study.

12 But generally speaking, if you can sell
13 your product, that helps reduce your costs, apply it
14 against your costs.

15 MR. BULLOCK: That's exactly the point,
16 Mr. Chairman, and with that word I will move on to
17 simply an administrative matter.

18 Would you like to break at five o'clock,
19 sir, would that be appropriate?

20 THE CHAIRMAN: Yes. Or if you like to
21 break now, that would be fine.

22 MR. BULLOCK: Q. One more administrative
23 thing perhaps that we could deal with then, and it was
24 a correction to the record, Mr. Penn. It was in Volume
25 122 of the transcript for Wednesday March 25th, 1992,

1 and it was at page 21389. Again, I believe it's simply
2 a recording error. You had been speaking about dry
3 used fuel storage.

4 MR. PENN: A. Yes.

5 Q. And my copy of the record, at least,
6 says, and I am reading from line 12:

7 Extensive R&D indicates that this
8 method is safe for one year and that the
9 containers are designed, as you have
10 heard before lunch, for transportation
11 which will reduce final used fuel costs.

12 [4:48 p.m.]

13 I take it that what you meant to say was
14 that this method was safe for at least 100 years, which
15 I understood to be the evidence of Mr. Johansen.

16 I take it that's probably a recording
17 error, meaning no offence to the reporters.

18 A. I think it was my evidence and I'm
19 very pleased you brought this to my attention.

20 It certainly should be 100 years, and I
21 guess we need to go through these transactions
22 carefully to make sure that obvious mistakes like
23 that...

24 Q. I had heard 100 years actually, sir,
25 and that's why I point out that I suspect that it was

1 just a recording error.

2 A. Thank you.

3 Q. Again, no offence intended to the
4 reporter.

5 MR. BULLOCK: With that, Mr. Chairman, I
6 think perhaps we could usefully break for the weekend.

7 My friend Mr. Watson advises me that he
8 would like to start, and I have no objection to that,
9 on Monday morning. He expects to be an hour or an hour
10 and a half.

11 I understand that he has a meeting out of
12 the country Monday afternoon.

13 MR. WATSON: That's correct, Mr.
14 Chairman.

15 MR. BULLOCK: If that's all right with my
16 friend Mr. Campbell.

17 THE CHAIRMAN: That will be fine.

18 MR. BULLOCK: Very good, sir.

19 THE CHAIRMAN: We will adjourn now until
20 ten o'clock Monday morning with Mr. Watson coming in to
21 cross-examine on behalf of the Municipal Electrical
22 Association and you'll be too anxious to return -- your
23 estimate looks as if you might be most of the rest of
24 the day, would that be right?

25 MR. BULLOCK: I expect I would be most of

1 Monday, sir, yes.

2 THE CHAIRMAN: Mr. Campbell.

3 MR. B. CAMPBELL: Mr. Chairman, in my
4 constant endeavor to stay ahead of Dr. Connell, I have
5 information for him. He had made a request dealing
6 generally with getting some greater detail of
7 information on the nature of used fuel, the
8 characteristics of used fuel.

9 We have a filing that could address that,
10 and if I could get the next exhibit number, please.

11 THE REGISTRAR: I'm sorry?

12 MR. B. CAMPBELL: The next exhibit
13 number, please?

14 THE REGISTRAR: 569.

15 MR. B. CAMPBELL: Thank you.

16 ---EXHIBIT NO. 569: Response to Dr. Connell's inquiry
17 on the nature of used nuclear fuel.

18 MR. B. CAMPBELL: And I can provide eight
19 copies to the Board and I have some copies for my
20 friends.

21 I know that Dr. Connell would not have
22 been happy with his weekend reading without this.

23 DR. CONNELL: Thank you very much.

24 THE CHAIRMAN: Some other intervenors may
25 be envious of Dr. Connell if these prompt responses...

1 We will adjourn until ten o'clock on
2 Monday morning.

3 THE REGISTRAR: Please come to order.
4 This hearing will adjourn until ten o'clock Monday
5 morning next.

6 ---Whereupon the hearing was adjourned at 5:00 p.m., to
7 be reconvened on Monday, April 6th, 1992, commencing
8 at 10:00 a.m.

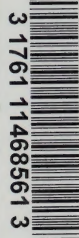


E R R A T A
and
C H A N G E S

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<u>Page No.</u>	<u>Line No.</u>	<u>Discrepancy</u>
22051	1	would pass s/r <u>would not pass</u>



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